MODERN Machine Shop

HOWARD CAMPBELL, Editor

olume 6 OCTOBER, 1933 Number 5

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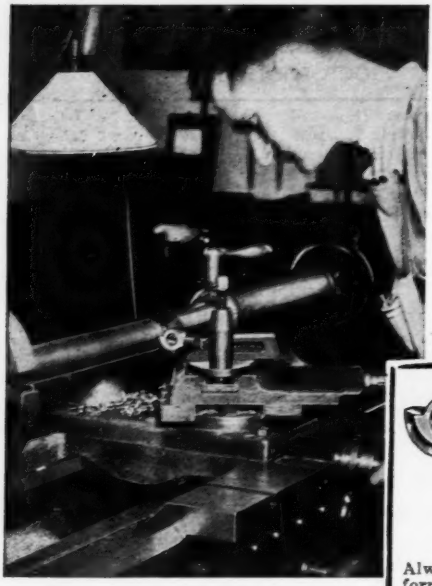

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MODERN Machine Shop

OCTOBER, 1933

CINCINNATI, OHIO VOL. 6, No. 5

Oscar Peterson

Building Automatic Vending Machines

Machines that serve or sell are familiar objects everywhere. This article describes some of the tools used in the building of these machines.

BY OSCAR PETERSON

Superintendent, Mills Novelty Company

THE demand for service by a fast-moving American public has, during the past decade or so, given impetus to the development of automatic service and vending machines which, upon the insertion of a coin in the proper place, will shine your shoes or deliver anything from a package of gum to a complete lunch. A package of your usual brand of cigarettes or a copy of the Saturday Evening Post may be obtained in the same manner. Coin-operated automatic machines do not stop with merchandising, however; as you leave your favorite restaurant you are confronted with an attractive weighing device which, for a penny, will reveal your weight. Or you can engage your friend in a complete baseball game, on a real but miniature diamond under a glass cover, your ability as a manager depending upon the skill with which you operate a coin-controlled plunger that strikes the ball and starts it on its travels around the diamond.

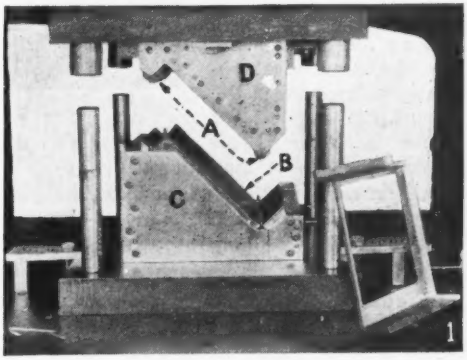
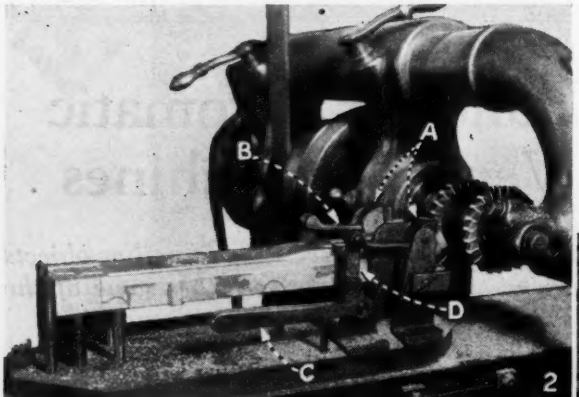


Fig. 1—With this die a flange is drawn around the edge of the front section for a gum-vending machine.

Automatic merchandising machines, service machines, and automatic games have proved their efficiency, and are increasing in number and variety. The mechanisms by which some of these machines perform their functions are marvels of ingenuity, but no less interesting are the mechanical operations involved in the production of parts for these machines. This article deals with some of the manufacturing operations on coin-operated machines as they are produced in the plant of the Mills Novelty Company, Chicago, Illinois.



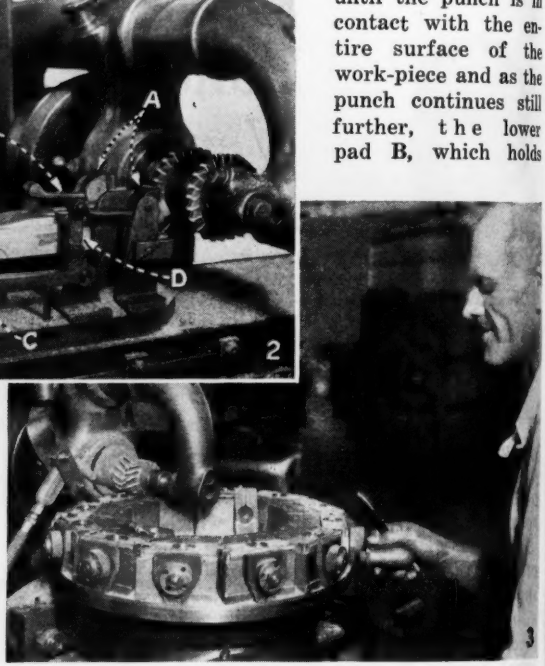


Fig. 2—Milling pads on a frame for a wall-type gum vending machine. The quick-clamping arrangement is interesting and efficient. Fig. 3—With this equipment 1400 payout slides are finished in seven hours.

Figure 1 of the accompanying illustrations shows a die that is used to draw a ½ in. flange around two sides of the piece of work shown leaning against the leader pin of the die. The piece is the front section of a casing for a gum vending machine. As the ram descends, the two spring pads A in the punch D strike the piece, which has been formed in a previous operation, and hold it in the proper position for the punch. As the punch continues its descent, the pads A and B recede until the punch is in contact with the entire surface of the work-piece and as the punch continues still further, the lower pad B, which holds the work in places against the punch, is forced down between the housing side plates C and the flange is formed and drawn. The upper inside edges of the side plates are rounded so that the drawing and forming process will be gradual.

It might be of interest to note here that all standard die parts, such as guide pins, bushings, springs, shoes, and so on, are maintained in stock in sufficient quantities so that the

highest speed possible may be made in the production of dies. These parts are supplied by the Danly Machine Specialties Company. As new vending machines, service machines, and coin-operated games are constantly being developed, speed in the production of tools is an important factor.

The piece shown in the milling machine, Fig. 2, will be recognized as a frame for a wall-type gum-vending machine. The operation is that of milling the pads through which the screws are inserted to hold the frame to its base. The interesting feature of this operation is the fixture in which the piece is held. A lever is provided on each side of the fixture, by which each one of the parts A is locked in place on the end of the work-piece. Instead of the customary screws, however, the clamp is held in place by spring pressure, the spring being an integral part of the clamp at B. By pulling the handle C to the horizontal position, the toggle D is raised until the clamp head A not only rests on the work, but the rear end of the clamp B is sprung slightly to apply the necessary pressure. The clamp is, of course, of tempered steel. The use of a toggle and spring-clamp in this manner promotes speed where the work-pieces are sufficiently uniform so that no adjustment is necessary.

In Fig. 3 a Brown & Sharpe miller is shown in operation, milling the surfaces of payout slides. The slides are of brass alloy, and are held, 12 at a time, in a rotary fixture which provides for continuous operation. Each of the 12 clamps is brought to bear on the work by screwing against

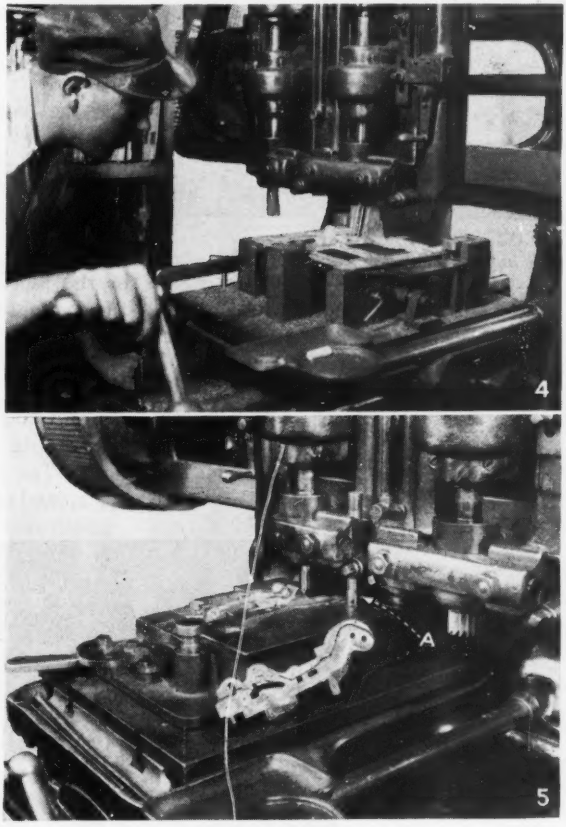


Fig. 4—Three different heights are milled on the payout base with two cutters. Fig. 5—Another profiling machine operation. With this equipment, an irregular-shaped slot is milled in a "goose-neck" coin chute and the surface of the piece is finished.

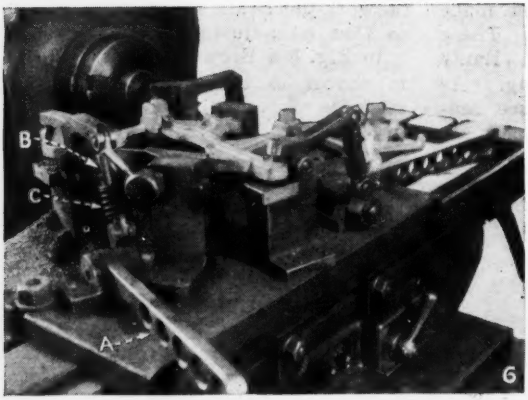


Fig. 6—Milling the side of a coin chute for a vending machine.

the work-piece a nut in which are four holes, as shown. The handle shown in the operator's hand has four pins which engage the holes in the nut. With this equipment 1400 pieces are milled in seven hours.

Some of the parts for vending machines are of intricate design, such as the payout base shown on the profiling machine in Fig. 4. Here a number of surfaces are required to be finished, three different heights being involved. Two of the heights are obtained by the use of cutters set at the heights required and the third is obtained by adjusting one of the cutters.

In Fig. 5 is shown another profiling machine, set up to mill the coin slot in a "goose-neck" coin chute. This part is of brass, and contains a coin slot which is extraordinarily crooked. Two cutters are used, the larger one being used to finish the surface of the piece. After milling the surface, the table is moved over until the follower pin A engages the guide-slot in the fixture. The piece is then fed through the machine, the follower pin forcing the fixture sidewise as required in order to follow the guide-slot. The coin-slot is milled ⅞ in. wide, and the width is held to the

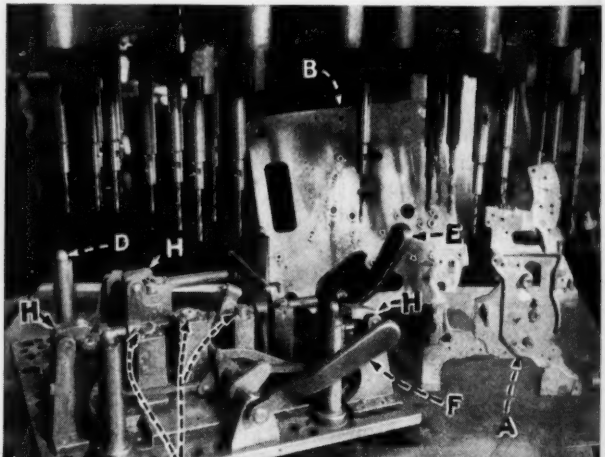


Fig. 7—Jig for drilling 23 holes in a side frame for a merchandising machine. The jig is entirely self-contained, clamps and mechanical supports being integral.

drawing dimension within limits of plus or minus 0.001 inch.

Another interesting milling fixture is shown in Fig. 6, where the operation of milling the sides of the coin chute can be seen. The piece is held in a fixture which locates it automatically, and is held in position by three clamps. Here spring pressure is again used to hold the work in place, but instead of a lever-type spring, a coil spring is used, with a sleeve. To release the work-piece, the operator throws the handle **A** to the vertical position, lowering the end of the pin **B** and releasing the pressure on the spring **C**. To clamp, the operation is reversed; thus the piece can be clamped almost instantly.

The 24-spindle Natco multiple drilling machine shown in Fig. 7 is set up to drill 23 holes in a side frame for a coin-operated machine. A drilled work-piece is shown at **A**, and the bushing plate is indicated at **B**. The bushing plate locates on the four posts **D** after the work has been placed in the jig, the four rounded studs projecting from the posts fitting into the four corresponding holes in the bushing plate.

The lever handle **F** controls a shaft to which are attached, by means of toggle levers, the clamps **H**. With the work in position in the jig, this handle is pushed downward, clamping the work at the three points indicated. The handle **E** is then also pushed downward, operating a series of "propel and repel" wedges which rise against springs under the bottom ends of the shafts carrying the support anvils **G**. The anvils are forced up against the under side of the work-piece, thus providing support against the drilling strain. Although the springs are strong enough to provide support, they also provide the necessary "give" to take care of variations in the casting.

The interesting part of the operation is the manner in which the clamping is done. No bolts, individual clamps, or other accessories are required; the entire clamping mechanism is integral with the jig and the clamping action is practically instantaneous.

The modern method of assembling parts by riveting is illustrated in

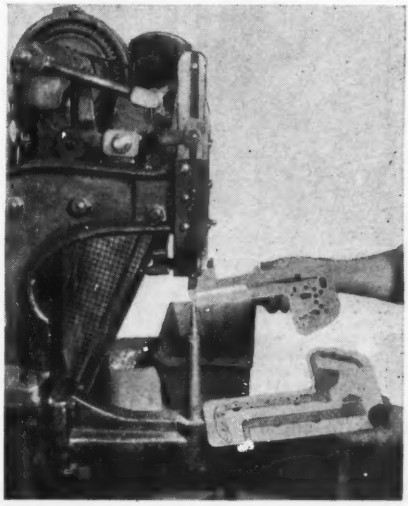


Fig. 8—Five pieces are assembled and riveted together in less than 30 seconds by the use of a jig and this Judson L. Thomson high speed riveting machine.

Fig. 8. The left hand of the operator is holding a plate of heavy sheet metal containing eight pins which are so arranged that four pieces can be placed in the correct position and alignment on the plate, the pieces being drilled so that they can be slipped over the ends of the locating pins. With the four pieces thus in position, a fifth piece, shown in the operator's right hand, is placed in position on the same plate and is riveted to the four smaller pieces. A Judson L. Thomson high speed riv-

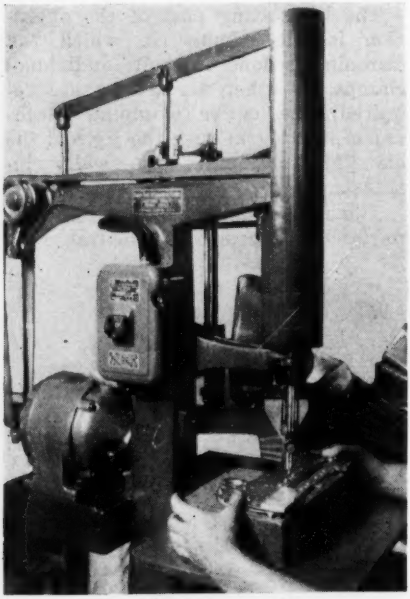


Fig. 9—The modern method of assembling work with machine screws. With this "Detroit" power screwdriver, 450 screws an hour are inserted and driven to place.

eting machine which feeds and heads the rivets mechanically is used, the entire job of assembling the five pieces and riveting them taking less than 30 seconds.

Another piece of modern equipment for performing an old and simple task is shown in Fig. 9, where a machine for setting and driving machine screws can be seen in operation. The operator is assembling the parts of a coin chute for a coin-operated vending machine, the operation consisting of driving eighteen No. 8-32 thd. machine screws. The machine, which is made by the Detroit Power Screwdriver Company, is equipped with a hopper into which a large quantity of the screws are poured, and from which they pass to the "setter" under the blade of the screwdriver.

With the piece in position under the end of the screw, the operator pushes a foot lever which lowers the screw to the surface of the work and follows it with the screwdriver blade. The blade, which is revolving at a speed of 1150 r. p. m., drives the screw almost instantly and is then released so that the blade can rise

(Continued on page 64)

Fig. 10—Section of the assembling department at the Mills Novelty Company

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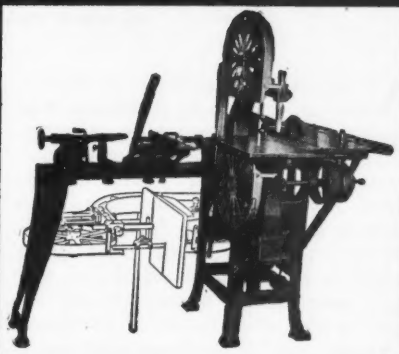

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Personnel Training at the Heald Machine Company

By C. J. Harter, General Manager

Harter Educational and Engineering Service, W. Boylston, Mass.

As told to Francis A. Westbrook

AS BUSINESS returns to normal, the importance of providing adequate training for machine shop employees and other members of the personnel of the metal manufacturing plant is certain to increase to a marked extent. This fact is due to several reasons. In the first place, hundreds of thousands of skilled men have been forced, during the depression, to seek other means of livelihood.

There has also been the usual shrinkage due to death and old age, and in a great many instances training courses have been suspended as a measure of economy. Another reason for a shortage of trained men is the reduction of working hours under the NRA program. The above reasons for the desirability of plant training courses are all in addition to those which have made it a necessity in the eyes of modern industry in the past.

In order to complete the picture and to provide an adequate background for the following discussion, it will be worth while to recapitulate the more important of the latter reasons and then show how industrial training courses have been organized and carried out in a specific instance —in this case, the Heald Machine Company, Worcester, Mass.

Doubtless there are many plants that are large enough to justify the inauguration of apprentice training courses, where the plant executives would like to see something of the kind done, but where nothing along these lines has thus far been accomplished. It is altogether probable that there are many instances where the matter of training has been considered, but discarded because no one has been sufficiently familiar with the matter to know how to go about it. In the absence of a clearly defined program, the thought has not been crystallized into action. A discussion of the training courses as established and conducted at the Heald Machine Company will, it is hoped, be helpful toward this end.

Let us now consider the reasons why in the so-called normal times of the past apprentice training was considered necessary. The president of a large brass works in Connecticut once said to an interviewer, when the question of personnel management was under discussion, that he had developed his mechanical equipment to a point where it could be depended upon in carrying out a pre-determined production schedule, but that this was not true of the workers in his plant. He considered that this situation was the fault of the management, and that proper apprentice training should be one of the remedies.

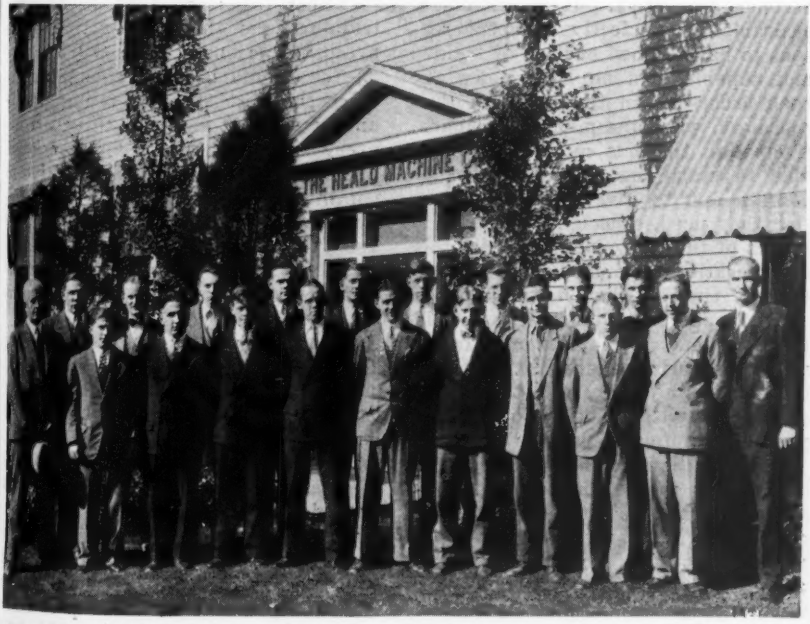
It is obvious that where there is a lack of proper industrial training, the chance is small, when hiring new men, that the right type for a given job will be secured. When skilled men were needed, it has been common

practice to secure them from other plants by the lure of slightly higher pay, which practice, however, tends to raise costs unnecessarily and to have a bad effect on the other plants. From the broad viewpoint this is uneconomic and in every way undesirable.

There is really no substitute for training in a company's own plant, for it is the most efficient method of developing skilled men for the particular conditions under which they are to work. Trade and other technical schools do not produce as high a type because, in the first place, the student does not receive the correct impression as to production time and other short cut methods used in actual practice. Furthermore, as every manager well knows, the methods in shops doing similar work vary a great deal and if a man is trained in another plant it is always necessary to give him more or less instruction before he can become proficient at his job.

In other words, all companies carry on more or less training whether it is recognized as such or not, and the ones which have a well set up system of training usually produce a higher class of work at less expense. For instance, practically all manufacturers have the facilities for apprentice and other training within their plants and offices, but it is not enough to take on some young men or boys and merely let them work around in the various departments without a well defined and purposeful plan. The right kind of mechanics cannot be developed in this way, though this is due to no fault of their own. No other educational enterprise is carried on in any such manner.

Apprenticeship training forms a basis for a supply of future executives



Group of apprentices, with their supervisor, at the plant of the Heald Machine Company. At the right is one of the Harter supervisors, Mr. Roger Montague. At the extreme is Mr. J. C. Harter.

because the young men are familiar with the product and the shop conditions, and at the same time have a knowledge of the required technical subjects. After graduation all that many of them require is the development which comes with a few years of shop practice and the maturing which only age can give. Men who have taken such training courses are usually the ones who make steady progress to the better positions, all of which tends very decidedly toward the happy result of reasonably contented workers. Thus the firm establishes a reputation which leads to a waiting list of applicants for the training courses, making it possible to select from among a desirable group of young men.

As a matter of fact there are very strong reasons why training courses should be established before business becomes too brisk. It is extremely desirable for perfectly apparent reasons to have a good nucleus of trained and capable men on hand when the rush orders begin to come in. Furthermore, when the plant is comparatively dull there is more time available to start the operation of such courses and to give them the attention they need, especially in the early stages of their development. Another consideration of much weight at the present time is that it would be in every respect consistent with the spirit and intent of the National Industrial Recovery Administration to increase employment by taking on young men without delay for the purpose of training them for the future.

Finally, the training should not be confined to those who are to become skilled mechanics. It should cover all of the various services involved in the conduct of a particular business, as was done at the Heald Machine Company.

The laying out of a group of training courses calls for great care. It has been found that the best results are generally obtained by training in the various production departments because it is practically impossible to reproduce actual working conditions in a special training, or vestibule, department. In the latter type of training, usually about all that a student gets is an elementary knowledge of the technical part of his work without having touch with the practical side. As a matter of fact, the student trained in a vestibule department is very likely to need considerable experience in the shop after graduation before he is worth very much, in order to become familiar with the conditions he finds there and to accustom himself to them. The departmental type is therefore not so long drawn out, and is also less expensive.

It is, of course, equally important to select the right type of boy for training, and this can only be done by an experienced person. The pay offered should be high enough to attract the best type of young people and gradually increase this perhaps every six months in order to encourage them and to give an incentive to continue. There is a sufficient number graduating each year to supply the required number of new skilled workers made necessary by anticipated growth or the average turnover, or both.

The training courses usually last four years and should be completely worked out before actual training is started. The training should be broad and must naturally be adopted to the particular needs of the plant in question and the purpose for which it is intended. For instance, the machinist should learn something of drafting in order to be able to read drawings and the mechanical draftsman should be given experience in the departments where the parts are made. This will become apparent when we consider

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how the Heald Machine Company courses are laid out.

Sales and service students are required to pass successfully an examination on each subject appropriate for them before going on to the next assignment. In fact, during the training of all types of students careful follow-up is essential. All phases of their work should be carefully scrutinized and at the same time consideration should be given to their personal characteristics with a view to classification after graduation. This supervisory work can be handled successfully only by a supervisor who has had broad experience in this work.

Industrial training of all types is handled for the Heald Machine Company by the Harter Educational and Engineering Service. This service was inaugurated several years ago for the express use and benefit of firms who desire to train the men in their organizations but who do not know how to go about it.

The Harter organization takes complete charge of the training of apprentices for the various trades, the training of competent workmen for positions as foremen, demonstrators, and salesmen, and the training of other students for special services. The amount of time spent by the Harter supervisors in each plant is dependent on the size of the group.

The manner in which the training courses were established and carried on at the Heald Machine Company is more or less of a typical case, and what was done here will apply in others, with variations dictated by local conditions. The courses set up covered the following:

Machinist apprentices,
Drafting apprentices,
Sales students,
Demonstrator students,
Short courses for regular salesmen,
Correspondence courses for outside and inside men,
Special courses for home dealers' representatives,
Special courses for foreign dealers' representatives,
Lectures for engineers and department heads.

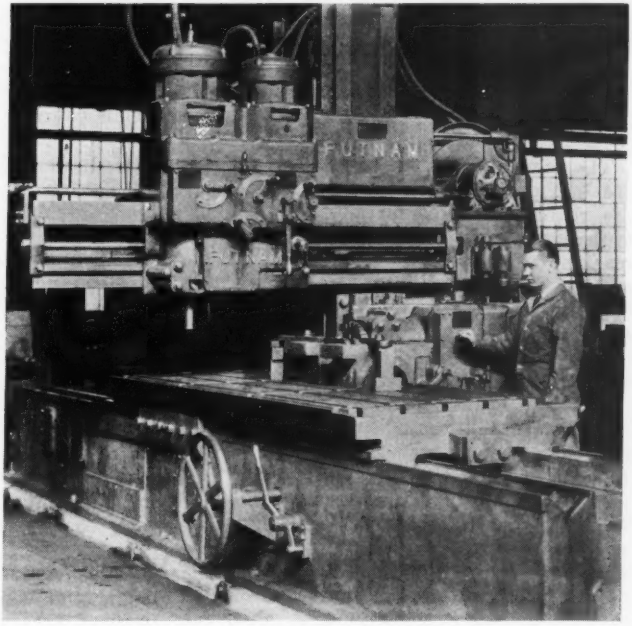
The first thing that was done was to make a survey covering all conditions that had any bearing on any of these courses and then to lay out schedules of shop time and technical subjects. All apprentices and sales students spend two hours each week in class and are required to do considerable home study. As already stated, all shop training is given in the regular departments of the shop.

Machinists' apprentices serve four years. The time is so divided that they receive experience on all types of machines according to the skill required. They also receive assignments in the engineering department so that they may become familiar with drawings and design.

A fine set of tools is loaned to each apprentice to use during his shop training, and these become his property upon completion of the course. He is usually started in the tool crib or on the engine lathe, and his schedule covers assignments on the milling machine, planer, boring mill, shaper, sensitive and radical drills, cylindrical and internal grinders, and all special machines. At the Heald plant, of course, stress is laid upon grinding as that is their specialty. Considerable time is put in on the sub and general assembly of their machines because in some cases apprentices, upon graduation, are selected for demonstration work. In all shop departments the apprentice works on regular machines and receives his direct instruction from the foreman and his assistants. However, he is at all times under the control of one of the Harter supervisors.

Class work consists of a review of mathematics and study of subjects

such as mechanics and all types of machine tools; in fact, everything related to his shop work. He also receives instruction in English, letter writing and drawing. The instructor for these is also furnished by the Harter Service. Examinations in all subjects are given frequently enough to give assurance that the students understand all the subjects they are taking.



Apprentice operating planer-type milling machine. Under the Harter system the apprentices receive their machine shop training on the regular production equipment.

A great deal of trouble is taken to suit the courses to the individual student and this has been found to be very much worth while. In some cases an apprentice may start on one course and after a trial period it may be discovered that he is better adapted for another. In such cases he is transferred. For example, after one boy was well started on a molder's course it was decided that he would not make good. Before releasing him entirely he was tried out in the engineering department with the result that he is today developing into a very fine draftsman. A man placed at work which he can do well naturally makes an exceptionally valuable addition to the personnel.

In fact, a direct effort is made to properly classify all students and with this end in view records are kept covering all phases of their work in the shop and in the class room. Reports on each student are also received from the foremen, and special examinations are given to select special types. In practically all cases certain characteristics will become apparent long before graduation. The important point is to be on the lookout for such developments and then take proper measures to develop these individual characteristics as soon as they appear. Thus the interest of the student is fostered by letting him feel the satisfaction of success and the best possible type of workers is produced.

All of these general principles outlined in connection with the handling of the machine shop apprentices apply

to the courses given to the men in the other departments of the Heald Company. As a matter of fact, they apply with equal force to the general scheme of courses in any plant.

Drafting apprentices serve five years. Their schedule covers experience in the machine shop, pattern shop and foundry. The bulk of their time is naturally spent in the engineering department. In the case of the Heald Company, which has no foundry of its own, the apprentices are routed through the foundry of one of the other Harter clients.

The schedules for the sales students are laid out to fit the individual and the requirements of his position. A typical schedule covers time in the machine shop on assembly, inspection and testing, and in the engineering department on detail and design. They are assigned to the office to acquire information on orders, specifications, adjustments, costs and so forth, to suit conditions. The student is also required to take part in a course of sales demonstrations. This course is laid out so that, as nearly as possible, conditions met in actual practice will be duplicated. The supervisor assigns each member of the class, with the exception of one who does the selling, to key positions in a hypothetical industry, including the president, chief engineer, chief inspector, purchasing agent and so forth. All details in regard to the plant have been laid out in advance and the class supervisor acts as the coach, giving the members the benefit of his experience. The ability of the student in "putting across" the sale is the basis of his grading.

Demonstrator students are given a very intensive training in the shop, where stress is laid on assembly, inspection, testing and customers' complaints. They also serve time in the engineering department and are assigned to actual outside jobs, in company with an experienced man, before being allowed to undertake jobs on their own responsibility. Class instruction is also given in subjects related to this type of work.

Regular salesmen are sent back to the plant periodically for short courses which cover all late developments in design. In each case the course is special to suit the requirements of the individual. They vary as to time from a few days to several weeks, depending on circumstances.

Special courses are provided for outside men. They are handled by correspondence, all work being sent to the Harter representative at the home plant. A typical course would cover a review of mathematics, drawing, mechanics, electricity, pneumatics, English and letter writing. Younger members of the engineering department, office and shop take similar courses.

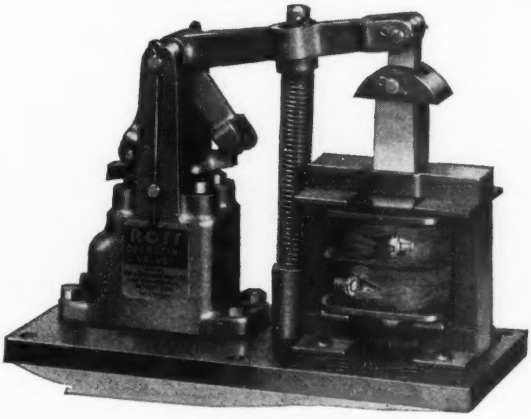
Dealers' representatives from both home and foreign territories are sent to the plant for training. Their courses cover periods ranging in time from a few weeks to several months, again depending on the circumstances in each case. Their courses follow very closely those laid out for company salesmen and demonstrators.

During the winter months courses of lectures are conducted for the engineers and foremen. They are given after working hours in the demonstration department where machines of each standard type are set up in running order. Each lecture is given by a specialist, and with the machine in actual operation.

This, briefly, covers the outline of courses given at the Heald Machine Company's plant. It can hardly have escaped notice that one of the points most frequently stressed is that the instruction for all classes of students is varied to suit the individual and according to the circumstances sur-

(Continued on page 24)

★New ROSS SOLENOID CONTROL VALVES



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High Lights on Heat Treating Tool Steels

An Interesting and Practical Discussion of An Important Subject

By Wm. C. Betz

REGARDLESS of the fact that the science of the working and treating of metals has progressed tremendously in the past several years, there are still many plants—some of considerable size—where the heat treating methods and equipment are still of a primitive nature. This condition is undoubtedly due, in many cases, to the fact that practical information, stripped of technical details and simplified to such a point that it can be understood without the aid of a technical education, is not easily accessible. In this article the author presents some data that have been gathered in the course of many years of experience in the working of tool steels.

We have learned that in order to properly heat treat high speed steel, the steel must be preheated very slowly to between 1500 and 1700 deg. F. in one furnace and then transferred to another furnace in which the heat is brought up very quickly to approximately 2400 deg. F., or hardening temperature, without soaking, in order to avoid blistering or burning the steel. Is there any good reason why carbon steels should not be treated in a similar manner?

Better results have been obtained by double furnace operation in the treating of both carbon and alloy tool steel. In other words, carbon tool steels should also be heat treated in two furnaces; one to heat the work very slowly to between 1000 and 1150 deg. F., and the other to heat the steel to approximately 500 degrees above the hardening temperature of the steel.

After the steel has been quenched, it should immediately be Rockwelled to make sure that it is at maximum hardness, or between 63 and 67 on the C scale. If the Schleroscope is used, it will be between 87 and 92. The piece should be drawn immediately to the temper required as determined by the Rockwell or Shore test.

If the piece after quenching does not register at least to the minimum hardness as mentioned above, one of two things have happened in the hardening process: (1) the steel has not been heated to the proper temperature, or (2) the piece has been overheated. In the first instance, annealing and rehardening will cure the trouble; in the second, the piece in all probability is scrap. At any rate it can never give maximum service, as there is no known method by which it can be restored to its original condition or usefulness.

Where quantities of tool steel are hardened, the ideal heating media is the salt bath. The work should be preheated as above before being placed in the bath and should be left in the salt until it assumes the same color as the bath; in other words, when the work is the same temperature as the bath, it will not be visible in the bath unless it is moved around in it.

Salt baths in use should be kept up to proper temperature by the use of pyrometers. They should be composed of salts that have an absolutely neutral action as regards decarburizing, and that do not sludge through continued use.

In the hardening of water-quenching tool steels, a piece heated in liquid salt and quenched will never be found with soft spots because the salt keeps a film on the work while it is in the bath and also while it is being transferred from the bath to the quenching tank. The salt film prevents oxygen from coming into contact with the hot metal. When the hot work strikes the water in quenching, the salt scale immediately blows off, leaving the work perfectly clean. The hardened piece generally assumes a clean gray color which is very desirable on tools that are made for the trade.

In heating certain oil-hardening steels, it is desirable to have the bath slightly carburizing in effect as steels of this type have a tendency to come from the quenching tank with a slightly soft skin. This skin may be as much as 0.010 in. deep, which is very objectionable. For the proper salts and equipment, the writer would refer the reader to either the E. F. Houghton Company, of Philadelphia, or the Bellis Heat Treating Corporation of Branford, Connecticut. The most efficient pots for salt baths are those heated by electricity through immersion couples. The pots are made of a special nickel chromium composition which enables them to withstand thousands of hours of heating. A part of the credit for this wearing quality is undoubtedly due to the fact that no flame impinges on the pots as the electric couples heat the salt direct.

After an electric pot has cooled off and the salt has solidified, the salt must be melted from an outside source of heat before it can be used again as the solid salt acts as an insulator to the flow of electricity. The melting is usually done with an acetylene or gas torch. The flame is played into the center of the pot in a circular motion, the circle becoming larger as the salt melts until the molten salt reaches the couples, when the electricity is turned on and the work of heating is completed.

Salt baths also make ideal heating media for high speed steel, where quantities of work are large enough to warrant keeping the pots going continuously. The frequent heating and cooling of salt baths from high temperatures have a detrimental effect on the pots in that they are liable to crack from the expansion of the salt in cooling. To avoid cracking it is best to pour all the liquid salt into a shallow receptacle and when it has solidified it may be broken up with a hammer to be melted and used again as needed.

In muffle furnace heating, it is always well to have the pyrometer read at least 50 degrees hotter than the required temperature for a given tool steel, because it is next to impossible to get the work exactly to the same temperature as the furnace and then we have heat loss in transferring the work from the furnace to the quenching tank. Altogether, 50 degrees is a fair allowance.

In the case of high speed steels the furnace should register at least 100 degrees F. hotter than the work requires.

In drawing high speed steel for secondary hardness; i.e., 1050 to 1100 degrees F., the Rockwell reading will generally be from one to two points higher than the original hardness reading, which should be from 63 to 66 R. on the C scale.

The accompanying chart is for use in converting temper colors to Rockwell readings on water and oil-hardening tool steels.

Rockwell C = 62—Straw yellow 450 F.
Rockwell C = 60—Dark yellow 485 F.
Rockwell C = 58—Coffee brown 510 F.
Rockwell C = 56—Purple and brown 560 F.
Rockwell C = 55—Dark blue 590 F.
Rockwell C = 54—Green Blue 610 F.
Rockwell C = 53—Old copper 680 F.
Rockwell C = 52—Light gray 710 F.

These colors and numbers will vary slightly between the various brands of straight carbon water-hardening steels and the alloy oil-hardening tool steels, but they provide a very good basis for determining the color that will approximate a given Rockwell reading on the C scale.

Pointers on Quarter-Turn Belt Drives

By W. F. Schaphorst

ALTHOUGH quarter-turn drives are seldom required, the average millwright or machine repair man undoubtedly considers the arrangement of a quarter-turn drive a very simple matter indeed. However, there are a few important points concerning quarter-turn drives which, while simple, are important and have a considerable bearing on the success of the drive and the life and service of the belt.

Side pull on the belt is inevitable in a quarter-turn drive, and unless the drive is arranged correctly, one side of the belt will be stretched more than the other and eventually the belt will become crooked. It then begins to work over to one side and in time will run off. The longer it runs after it has reached this stage, the harder it will be to keep it on the pulleys. Also, the joint will be likely to open on one side.

Where the distance between pulleys is sufficiently great, this evil can be remedied by giving the belt a half twist before the ends are joined. That is, instead of joining the ends in the usual manner with the belt perfectly straight, one end of the belt should be turned over and the ends then joined. This half twist will cause the belt to present alternate sides to the pulley with every revolution, and the tension on the edges is thus equalized.

A good rule to follow in laying out a quarter-turn drive is this: The distance between shaft centers should be at least five times the diameter of the larger pulley. Thus, if the larger pulley is 20 in. in diameter, the distance between shaft centers should be at least 100 inches.

A properly-designed quarter-turn drive will transmit almost as much power as a normal open drive under the same conditions. But it is wise, nevertheless, to use a belt from 5 per cent to 10 per cent wider in order to assure a sufficiently high factor of safety.

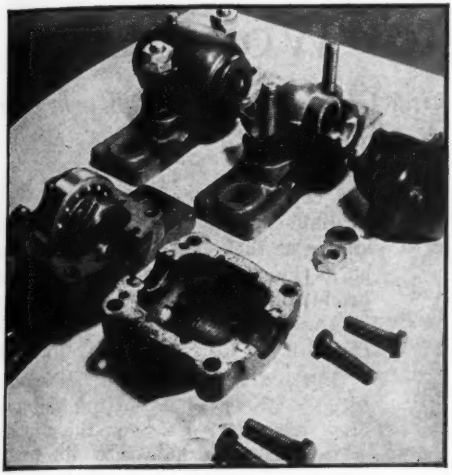
Wherever possible, the pulley on the vertical shaft should be the driver; that is, provided one of the shafts **must** be vertical. The tight side of the belt will then be between the driving pulley and the pulley on the horizontal shaft. Obviously, if the pulley on the horizontal shaft were the driver and there were any slackness in the belt, trouble would be experienced.

Personnel Training at Heald

(*Continued from page 20*)

rounding each session. This is extremely important, for it not only avoids the stereotyped, uninteresting type of instruction which may or may not be of value to the student, but it also brings him close to reality and so stimulates his interest and intellect.

DID YOU KNOW ?



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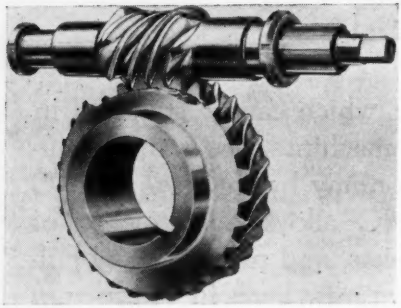
Theoretical Advantages Realized in "Cone" Worm Gear

Practical Method of Generating Globoidal Type of Worm Gear Developed By Michigan Tool Company

FOR many years engineers have known that certain advantages would be realized were it possible to cut an enveloping worm gear of the design variously known as the Hindley, Hour Glass, Globoidal or Hollow Type. In design, the gear has long existed; the production of the gear by any of the usual gear-cutting methods has, however, been considered an impossibility. In fact, the general opinion concerning the "globoidal" type of worm gear was set forth many years ago by one of the outstanding gear engineers of this country, who said: "This would indeed be a wonderful type of gear were it possible to produce same."



Six-Threaded "Cone" Worm Gear, cut down to the midplane of the worm wheel showing line contact on four teeth simultaneously.

A practical method of generating a worm gear of the "globoidal" type has now been developed, and both the special machine required and the special cutters for cutting the gear are available to industry. The gear is known as the "Cone" Worm Gear, and both the method and the tools for producing the gear are being offered by the Michigan Tool Company, 7170 Six Mile Road, E., Detroit, Michigan.

One of the chief difficulties encountered in the past in cutting this type of worm wheel has been the problem of getting the hob into its proper axial relationship without destroying the desired tooth form of the worm wheel blank. It is apparent that a tangential feed, as commonly used in cutting the parallel type, would completely destroy the Hindley wheel teeth. On the other hand, if the feed, instead of being in the direction of the hob axis, should be at right angles thereto, or parallel to the wheel blank axis, then the wheel teeth would also be destroyed to a great extent. The futility of such processes apparently left but one alternative and that was to feed the centers toward each other. In so doing, especially in the early stages, the hob and blank rotating on centers different from the designed ones, caused an out of timed relationship which destroyed a large portion of the desired contact.

The "Cone" Worm is generated by means of one or more straight lines, operating entirely in the axis of the worm and tangent to a circle which will be formed by extending the sides of the worm wheel. The final generating is accomplished with the cut-

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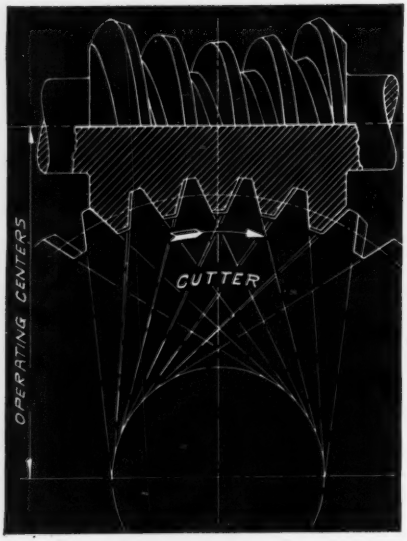
ter and work piece positioned as the worm and worm wheel will later operate in service.

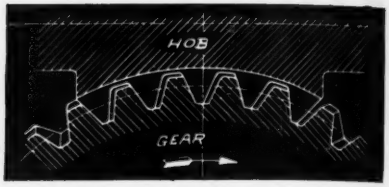
This is clearly illustrated by the diagram below.

The "Cone" Wheel is generated with a hob having thread flanks of identical mating capacity with the worm, but of thinner cross section; in other words, a worm having considerable backlash when mated with the wheel.



Generating Worm with Cutter Representing Midplane of Wheel

The roughing operation is accomplished by advancing the centers of rotation toward each other. The thin hob leaves sufficient stock on the wheel blank to permit subsequent cutting. The final form is imparted by changing the relative rotative positions of the hob and work piece; that is, by an angular shift of either the hob or work piece about its axis. The normal rotation is advanced while finishing the flanks facing in one direction and by retracting it angularly while finishing the reverse flanks. The

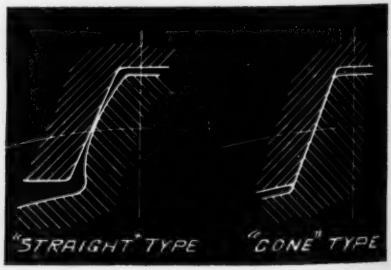


Generating Wheel with Thin Tooth Hob on Operating Centers

center distance and timed relation are fixed during the finishing operation. Hence the true form is generated. See illustration above.

In the "Cone" gear the worm flanks and wheel teeth, when cut by any plane passing through the worm axis, are both straight lines, tangent to a common circle, and hence contact simultaneously for the full depth of the thread and tooth. In the conventional worm gear the flank is of the involute form; whereas, the worm thread is a straight line when intersected by a plane passing through the worm axis. Point contact necessarily results. The marked difference in instantaneous contact is accordingly explained. This will be clearly seen by the diagram below.

The "Cone" worm, due to its ends being larger in diameter than its center, provides a worm structure which follows the true curvature of the wheel. This permits the generation of a worm, having a constant cir-



Point Contact Contrasted to Line Contact

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Dear Mr. Bute:

You will be interested in receiving the attached set of notes covering a very fine performance by the J. J. Ross Saw Filing Machine Co., of your Molybdenum blade in the J. J. Ross Mill Furnishing shop. This is proof that the Molybdenum blade is all that you claim for it, and then some.

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Gentlemen:

We hand you herewith four sheets of records made by our machinest showing the number of cuts and sizes of bars made with one of your Molybdenum Power Hack Saw blades.

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J.J.Ross/E

3 cuts	4 15/16" C. R. Shaft
11 "	1 1/2" C. R. Shaft
3 "	1 1/2" Black Pipe
2 "	3/4" C. R. Shaft
2 "	1 7/16" C. R. Shaft
1 cut	5/16" x 5/16" x 3" Angle Iron
1 "	1/2" x 4" Flat
3 cuts	3/4" x 1 1/2" Flat
1 cut	3/8" x 1 1/2" Flat
1 "	3/4" x 3/4" Key Stock
2 cuts	3/4" x 1 1/2" Mild Steel
1 cut	3/16" x 2 1/4" Mild Steel
1 "	3/4" x 3/4" Key Stock
1 "	3/4" x 1 1/2" Mild Steel
1 "	3/8" x 1 1/2" Mild Steel
11 cuts	1 1/2" Black Pipe
1 cut	3/4" x 5/8" Key Stock
15 cuts	2" Extra Heavy Pipe
19 "	1 1/2" C. R. Shaft
3 "	4 15/16" C. R.
1 cut	1 11/16" C. R.
1 "	1/2" C. R.
9 cuts	1 1/2" Pipe
40 "	2" Extra Heavy Pipe
18 "	1 1/2" Pipe
2 "	1" x 1 1/2" Tool Steel
1 cut	3/4" Cold Rolled
2 cuts	1 1/4" Cold Rolled
1 cut	1/4" x 1 1/2" Mild Steel
1 "	5/8" Cold Rolled
1 "	11/16" Cold Rolled
2 cuts	1 3/16" Cold Rolled
13 "	1/4" x 1/4" x 2 1/2" Angle Iron
1 cut	1 11/16" C. R. Shaft
2 cuts	2 7/16" C. R. Shaft
1 cut	15/16" C. R. Shaft
1 "	1" x 1" Key Stock
2 cuts	1/4" x 2 1/2" Mild Steel
2 "	1/2" x 1 3/4" Mild Steel
2 "	15/16" C. R.
2 "	1/4" x 1 1/2" Mild Steel
2 "	1" C. R. Steel Shaft
1 cut	1/2" x 3/4" Key Stock
1 "	1/2" x 1/2" Key Stock
1 "	2 1/2" Black Pipe
7 cuts	1/2" x 1 3/4" Mild Steel
1 cut	1 11/16" Cold Rolled Shaft
1 "	1/2" x 4" Mild Steel
1 "	3/4" x 1 1/2" Mild Steel
1 "	3/4" x 1 1/2" Mild Steel
1 "	1/8" x 2 1/2" Spring Steel
1 "	1 11/16" C. R. Shaft
3 cuts	3 15/16" C. R. Shaft
3 "	2 7/8" C. R. Shaft
2 "	4" SAE 1040
6 "	1" Black Pipe
4 "	1" Extra Heavy Pipe
1 cut	15/16" C. R. Shaft
7 cuts	1 1/4" Extra Heavy Pipe
6 "	3/8" x 3/8" Key Stock
1 cut	2" C. R. Shaft
2 cuts	1" C. R. Shaft
1 cut	2 1/2" Columbia Tool Steel
1/2 cut	2 1/2" Columbia Tool Steel

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cular pitch corresponding exactly with the constant circular pitch of the worm wheel. In contrast with the "Cone," the conventional or "straight" worm has the same diameter throughout its length and consequently does not have a constant circular pitch but on the other hand, has a constant

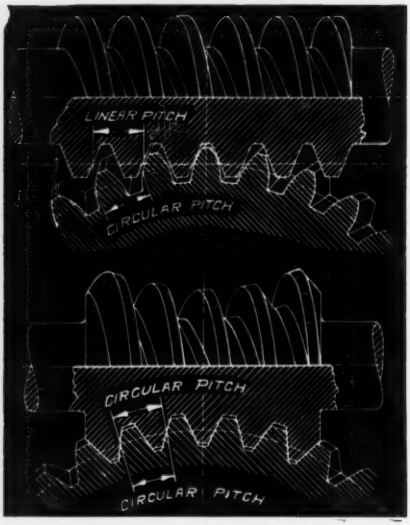

Diagram Illustrating Structure of (Above) Straight Type of Worm Gear and (Below) Cone Type

linear pitch. Its mating wheel has, however, a constant circular pitch.

It will be understood that in the conventional type of straight worm gear, only point contact is possible in any one plane passing through the worm wheel, such as the midplane. It is appreciated of course, that in the conventional type of worm gear, due to the thickness of the wheel face, other points of contact occur above and below the midplane, consequently the maximum theoretical contact at any instant, is a line of fairly short length, dependent somewhat upon the design. In actual service, this theoretical line, under deflection, becomes a small band or "zone." With the "Cone" type of gear, generated in accordance with the new principle, lines of contact occur in the midplane simultaneously on as many teeth as the particular design envelops. Similar lines occur above and below the midplane, just as points occur above and below this plane in the conventional type. The result is theoretical area contact. No other worm gear has it. The difference in structure between the two types of gear is illustrated by preceding diagrams.

In order to understand the "Cone" method of generation, one has but to picture a Hindley worm of straight sided section, so generated that the circular pitch is constant in the axial plane. Visualize further such a worm mounted in the housing with which it is to operate in service, and imagine a piece of plastic material in the form of a worm wheel also mounted in said housing, in the identical position that it is to occupy in service. Imagine now, that up to this time no teeth at all have been cut in the worm wheel. Then set the worm in motion. It will become apparent that in its passage through the wheel, it will remove any interference that might exist and yet, at the same time generate a form having the maximum amount of contact possible to secure.

Now picture the reverse condition for generating the worm and you have the "Cone" type of worm gear. The result is that this type of gear tends to wear into angle, pitch and twist in actual service. In other words, any slight errors that are introduced during manufacture and assembly will correct themselves, as the wear that takes place corresponds in its nature to the method of generation.

This is not true of the conventional type of worm gear. The worm is an arbitrary form. As stated before, the worm wheel has a constant circular

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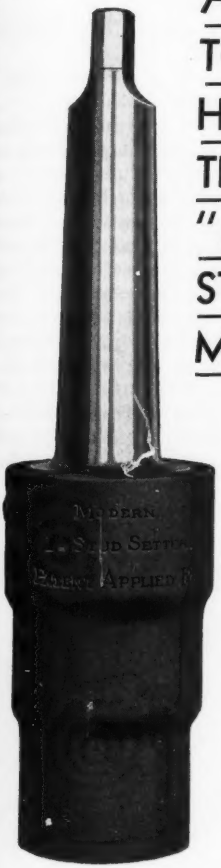

The "MODERN" STUD SETTER has speed — its action is instantaneous — it is accurate — and they are economical to use. What more could you ask for? They are used on electrical or air driven tools, or in drill presses and are made in two regular sizes to accommodate up to ½" or ¾" studs. Also made special in a heavy duty size for rapidly setting studs of coarse lead up to 2" diameter. Write for a bulletin advising the size studs you use, and full information will be sent promptly.

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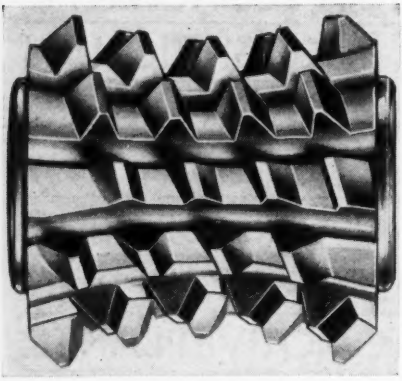
pitch but the worm has a constant linear pitch; hence the worm will not be reproduced when the worm wheel causes wear to occur on it.

In the past, Hindley gears have



"Cone" Hob

been unduly sensitive to alignment. We believe that this condition resulted largely from the fact that the gears were not properly generated. They were of poor mating capacity even when properly aligned. No interference will occur with a "Cone" gear when the out-of-alignment does not exceed the backlash. Only loss of contact results.

No difficulty has been encountered with the "Cone" gears when assembled within reasonable limits. As stated above, wear in service will correct reasonable errors in manufacture and assembly.

Advantages claimed for the Cone Worm Gear are:

Thirty times as much instantaneous contact as the parallel type.

Less unit pressure, consequently less heat, less wear and higher efficiency.

The highest efficiency ever recorded with a worm gear; viz., 99.34 per cent, was obtained when a "Cone" worm gear was used.

The highest load carrying capacity of any worm gear for a given size.

The "Cone" worm, as well as the worm wheel, wears in. No other gear has this characteristic.

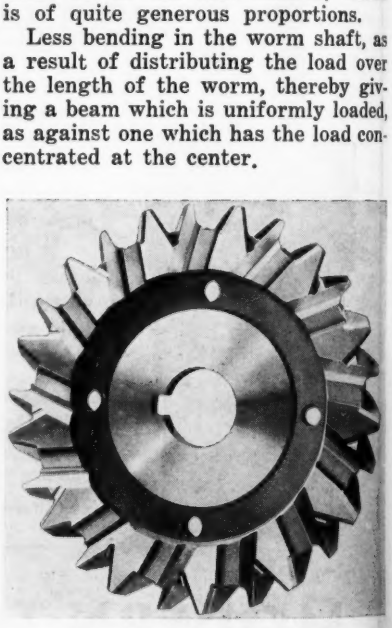
"Cone" gears successfully operating at 30,000 r. p. m.

Distribution of the load over a greater number of teeth.

Distribution of the load simultaneously over the full tooth depth.

Ability to resist "stripping," resulting from the distribution of the load between more teeth and the removal of bending stresses on the teeth. In order to strip the teeth of a "Cone" gear, it will be necessary to shear them off at the root section, which is of quite generous proportions.

Less bending in the worm shaft, as a result of distributing the load over the length of the worm, thereby giving a beam which is uniformly loaded, as against one which has the load concentrated at the center.



"Cone" Worm Generating Cutter

Silence and smoothness in operation, resulting from multiplicity of teeth in simultaneous contact.

IDEAS FROM READERS

Tool for Boring Ball Sockets

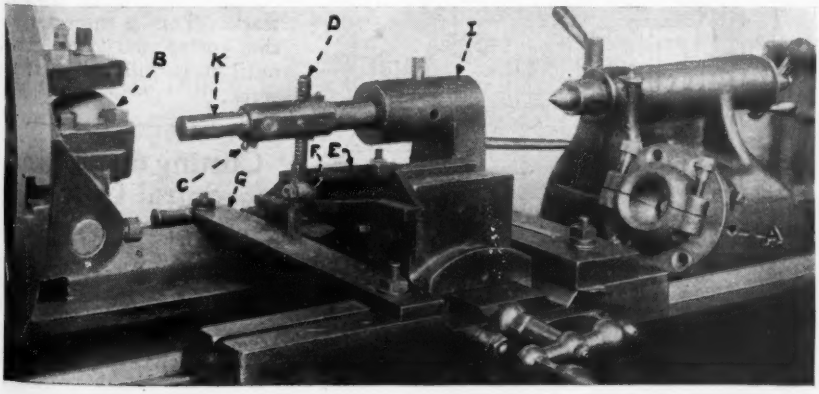
By Avery E. Granville

THE operation of boring comparatively shallow capped ball sockets is often performed by the use of spherical or ball-shaped milling cutters or reamers, and sometimes a single formed boring bar cutter is used. However, when the sockets are deeper, or well hooded over, the problem is not so simple.

The accompanying illustration shows an easily-made device for boring ball sockets, the device being made for use on an ordinary engine lathe. The type of ball socket for which the tool was designed is shown at **A**. The casting in the jig, indicated at **B**, is of a different form, but has the same kind of ball socket in it.

The device shown in the illustration consists primarily of a rack, an intermediate gear, and a gear segment in which the tool is located. This mechanism is located in a recess in a shaft that has a pilot at one end and is anchored at the other end in a casting **I**, which, as shown, is bolted to the carriage. A cam-slide is bolted to the side of the tool block. The tool is indicated at **C**, the rack at **D**, and the cam-slide at **E**. To the lower end of the rack is attached a cam roller **F**, which rides in the cam-slide and forces the rack up or down as the toolblock is fed across or back. The lower end of the rack slides in a square hole in the bar **G**, which is bolted to the saddle of the lathe. The upper end of the rack is steadied by the bar through which it passes.

It will easily be seen that as the toolblock is moved forward or back across the lathe, the rack will be moved up or down, revolving the intermediate gear and thus, in turn, revolving the gear segment in which the tool is located. As the segment revolves, the tool moves in an arc. Either hand or power feed may be used, as the circumstances dictate. The outer end of the boring bar, **K**, is made to fit a hardened steel bush-



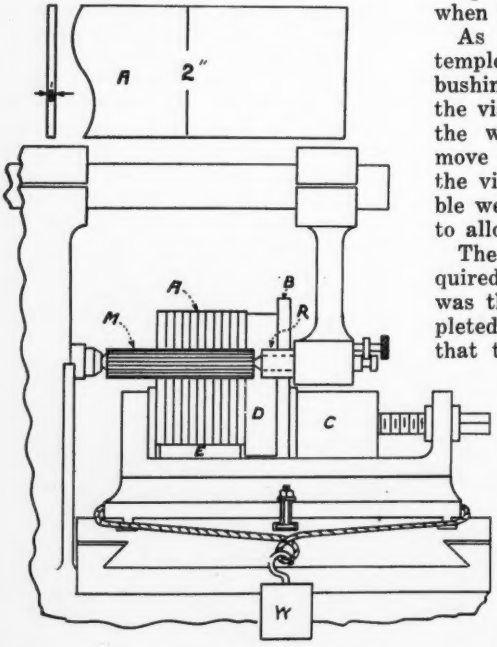
Tool for boring a radius

ing that is inserted into the spindle nose, so as to guide the bar and hold it steady while the cut is in process. By using a slow cross feed on the finishing cut, a very good finish is obtained in the sockets and only a little work with a fine emery cloth is required to produce the desired smoothness.

A Simple Method of Contour Milling

By William Anderson

A JOB that recently came into our shop consisted of machining the edges of 100 pieces of stamping steel



Set-up for contour milling

according to the design A on the accompanying drawing. As the necessity for accuracy and the requirement of low cost were factors that had to be considered, an expensive fixture was out of the question. The method finally evolved was probably as accurate and as simple as anything could have been, regardless of cost.

A templet B was laid out to the design A and was then cut and filed to shape in the filing machine. A cutter M was selected, then a bushing R was made to the same diameter as the cutter and slipped over the center as shown. The templet and work were clamped side by side in a milling machine vise, the templet being separated from the work by the spacer D. A spacer E was also used under the work to lift it from the table enough to provide clearance for the cutter when at the bottom end of the cut.

As it was necessary that the templet B be kept in contact with the bushing R, a cable was passed around the vise and attached to a weight W, the weight being heavy enough to move the vise. The bolts by which the vise was held to the machine table were, of course, slackened enough to allow the vise to slide.

The work was hand fed to the required depth, then a fine vertical feed was thrown in and the job was completed in one cut. It will be noticed that the templet is higher than the work. This is necessary as the cutter must be guided until it is fully clear of the work.

Cutting an Internal Spiral Groove

By L. G. Warren

THE job of cutting a number of internal spiral grooves fell to my lot, and I discovered that the only machine with which the job could be done was a milling machine. Accordingly, I handled the job as follows.

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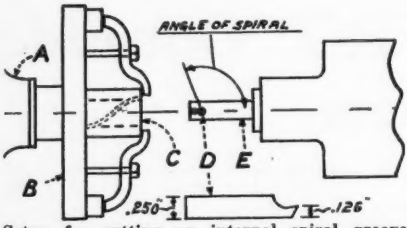
Cincinnati "HYPRO" Openside Planer

First, I geared the dividing head for the desired lead of spiral. Then I strapped the work C to the faceplate B of the dividing head spindle A. As the width of the groove was



Setup for cutting an internal spiral groove with a single-point tool and a milling machine

to be ¼ inch, I made a cutting tool of drill rod and ground it to this width. The tool was locked in position as indicated at D in the bar E, and the bar was inserted into the spindle of a universal milling attachment. The attachment was then swung to the horizontal position and the spindle was locked so that it could not turn.

It was found necessary to set the tool so that the cutting edge was at right angles to the groove; i.e., the same angle as the angle of the spiral that was to be cut, and the tool was set central with the work. The depth of cut was controlled by the use of the cross-slide. In performing this operation, the table can be cranked by hand for the cut or driven by the power feed if, as mentioned, the spindle drive is disconnected. In cutting a groove 0.250 in. wide, a cut of 0.002 in. to 0.003 in. deep at each pass does not make for rapid production, but for such a job as the one described above it is the most economical method.

Inexpensive Trepanning Tool of Welded Design

By John McCullagh

AN INEXPENSIVE trepanning tool of welded construction for general purpose work, such as encountered in a railroad shop, is shown in the accompanying illustration. The body of the tool consists of a taper shank A, a pilot B, driving key and flange which are made integral. The trepanning member is made up of a heavy collar and three formed blades, as shown at C, and is pressed on to the pilot end of the body where it is held secure by a key and nut.

The formed blades are welded to the periphery of the collar, equally spaced, so that they project downward as shown. The cutting edges of the blades are slightly thicker at the extreme corners than through the remainder of their length, both as an assurance of ample clearance and to avoid any possible binding action as

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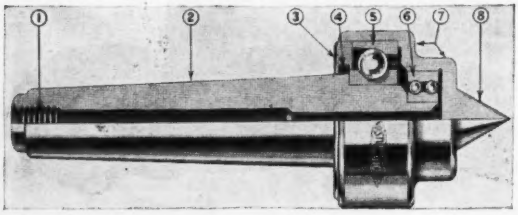

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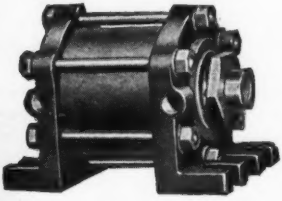
Standard Non-Rotating Cylinders manufactured in six styles. Style 1 shown.



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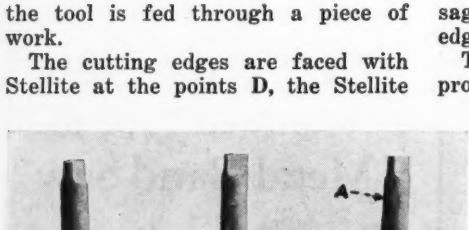
the tool is fed through a piece of work.

The cutting edges are faced with Stellite at the points D, the Stellite



Welded Trepanning Tool

being welded on by means of an acetylene torch. The amount of Stellite varies with the size of the tool being made, but a facing 1 in. long by ½ in. thick will be satisfactory for most diameters. Tungsten or tantalum carbide can also be applied if the nature of the material being machined permits their use.

The formed blades are made triangular in shape and are curved to the proper radius before being welded to the collar. They are cut so that a rake angle of about 10 degrees is produced. The heel edge is made with a steep angle to provide suitable chip clearance as well as to facilitate passage of the coolant to the cutting edges.

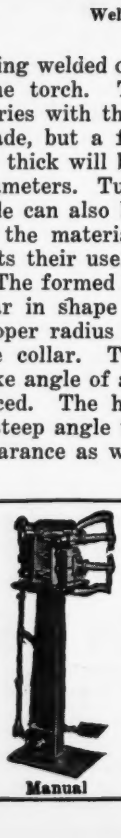
The pilot is made long enough to project below the cutting edges of the blades in order that it may be inserted into a previously drilled hole in the work before the trepanning operation is begun.

Preventing the Loss of Jig Bushings

By Peter L. Budwitz

SLIP bushings are used universally today in the construction of jigs. In nearly all plants where mechanical products are manufactured in quantities, certain parts will be found of similar or identical design but varying in size in which holes of different sizes are to be drilled in the same locations. The usual procedure in the designing of such jigs would be to utilize slip bushings. Slip bushings are fastened in the jig, when in use, by a conventional method of locking, but it is an easy matter for loose bushings of that type to be lost, misplaced, or broken, thus tying up the job.

The accompanying illustration shows a common type of jig to which is attached an auxiliary plate A for holding the various sizes of bushings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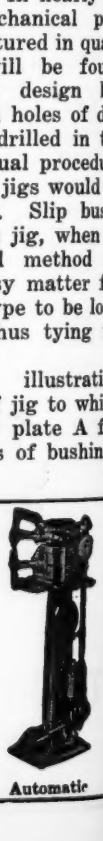
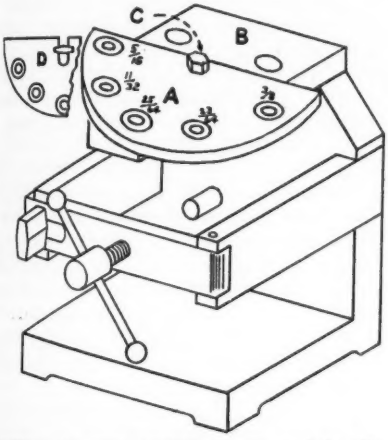

Automatic

that are used in this jig. The jig is used to drill a part which is standard for all sizes of the product on which the part is used with the exception of the holes, which vary in size with the different sizes of the product. The holes in all parts are, however, in the same location.

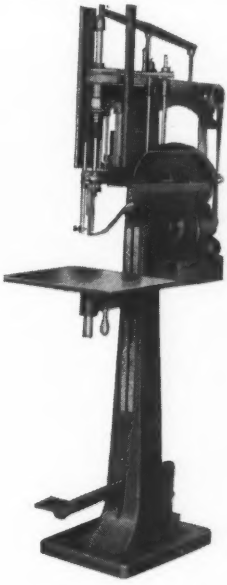
The bushings are pressed into the auxiliary plate, the plate being thin enough so that the ends of the bushings protrude. The protruding end



Drilling jig with auxiliary plate to hold slip bushings

of the bushing selected is slipped into a hole in the main plate B and the capscrew C is used to lock the auxiliary plate in position. Thus each bushing is quickly available and there is no chance for a bushing to get lost unless the plate is removed.

Where jigs are used for parts that are to be drilled, reamed, and counterbored in one setting, the rapid changing of the bushings thus necessitated can be accomplished by using a quarter-turn thumb screw in place of the capscrew. In this case an elongated slot will be required in place of the hole, as indicated at D, so that the plate can be shifted as required.



Drive Screws Faster with the Universal Magazine-Feed Screw-Driver

NOT only does the Detroit Power Screw-Driver drive machine, wood, cap, self-tapping screws of standard and special heads faster so as to cut your costs, but the universal adaptability of the machine enables you to keep it busy on many different jobs. Model B-2, illustrated above, drives any screw No. 4 to ¼" in size, ¼" to 1¼" long. Every detail of design, lubrication and mechanical construction is excellently combined to offer the most modern production methods from a tool of finest craftsmanship.

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Over the Editor's Desk

Industry-Planning

A PRODUCTION plan for industry by which each industry would operate according to a definite schedule similar to the production system of a well-organized factory has for many years been regarded as a possible remedy for our economic ills. As Mark Twain said about the weather, however, "Nothing has ever been done about it." Nothing has been done because such a plan would be possible only if a basis could be found upon which all future activities of each unit could be predicated. And heretofore no such basis has been possible.

According to John F. Sherman, President of the National Industrial Advisory Corporation, it is becoming increasingly evident that the remedy for the economic ills of our industries is industry-planning. And industry-planning, Mr. Sherman says, means the adoption of methods which will aid a particular industry in promoting a proper coordination of production and consumption to the end that an orderly and progressive business life within that industry, and the best possible relationships with other industries, may be developed.

All of which constitutes a large order, and one that will not be carried through to completion in a few days, or a few months. It is interesting to note, however, that a number of important industries have arranged their Codes to set up planning and coordinating committees, thus signifying their cooperation in the setting up of a national program of economic planning. Trade associations for practically every industry have existed for years, serving principally to gather statistics regarding production and merchandising policies, costs, and so on. These data will now become doubly useful; dependable statistics are indispensable to intelligent planning.

Mr. Sherman advises that the first step in industrial planning should be a thorough survey of the possibilities for distribution, ignoring all precedent and tradition. He says that by going at it scientifically it is possible to set an objective for the industry two, five, or ten years into the future and control the expansion or contraction of the industry to a satisfactory degree.

We hope he is right; such a state of affairs is a "consummation devoutly to be wished." One thing is certain; i. e., nothing is ever finished unless somehow, sometime, a start is made, and we will have to concede that, at least, something is being done.

(Form 3602-L)

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PURSUANT to statements made on page 43 of the September issue of MODERN MACHINE SHOP, the United States Post Office receipt showing the number of copies of the September issue of this magazine that were placed in the mails is reproduced above.

NEW SHOP EQUIPMENT

Baker No. 3 Contour Grinder

The illustration shows the Baker No. 3 Contour Grinder which has been added to the line of contour grinders, Baker h. d. drilling machines, multiple spindle drills, keyseaters, and special production machines made by Baker Brothers, Inc., Toledo, Ohio. This machine is of somewhat heavier design, with a larger table and built to operate at higher speeds than the No. 2 Contour Grinder which was described in the June, 1933, issue of this magazine.

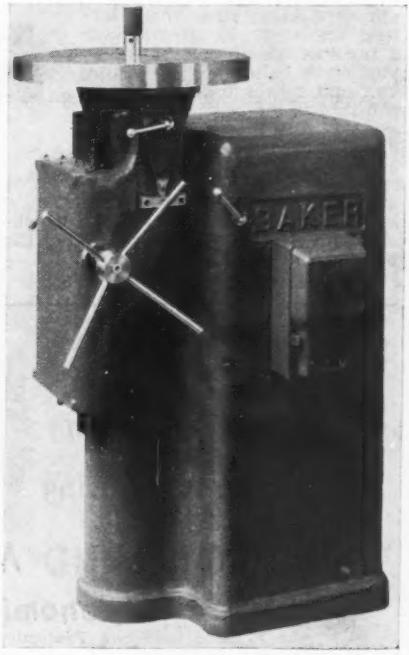
The No. 3 Baker Contour Grinder is designed to provide a simple but rapid and economical method of accurately finishing and polishing contours of all shapes. It is especially adapted to meet the needs of tool and die shop. The machine consists primarily of a horizontal table upon which the work is held, and a vertical spindle which both revolves and reciprocates vertically. The spindle is driven by a V-belt from a standard motor mounted directly to the rear of the spindle assembly, and full enclosed in the main column. Three changes of speed are provided from the V-belt drive to accommodate the different diameters of wheels. The reciprocating action is obtained by the use of a cam which is driven through an auxiliary drive from the main motor.

The table is 18 in. in diameter and well ribbed, allowing for close alignment between the table and the spindle. A T-slot is provided in both front and rear for applying the diamond dresser or any attachments which are to be mounted on the table. Vertical movement of the table is accomplished through a capstan handle. The table is mounted so that it can be at any angle up to 10 deg. either side of center for grinding angular relief on dies or other angular grinding. A graduated pointer indicates the angle of the setting.

The machine is furnished for motor drive only, the motor being located in a vertical position and mounted on a pivoted base so that the belt is automatically tightened. The standard motor used on this machine is 1½ h.p., 3600 r.p.m. and is furnished with standard equipment for the machine, complete with start and stop control.

Standard wheels of both the pencil and cup types are used, and unless otherwise specified are the equivalent of Norton specification 3860-K.

The machine uses wheel from ½ in. to 4 in. diameter and up to 3 in. face. The spindle is made with a special short More No. 3 taper, and the spindle end is



Baker No. 3 Contour Grinder

arranged with a quick action chuck adapted to the various types of solid and cup wheels and polishing drums used with the machine. The maximum distance, surface of table to floor, is 45 in.; minimum, 40 in. Total reciprocation movement of the spindle is $\frac{7}{16}$ in. and the reciprocating speed is 90 per min. The spindle speed is from 3600 to 7200 r.p.m. Floor space required, 24x30 in. Weight, 900 pounds.

Natco Self-Contained Hydraulic Unit

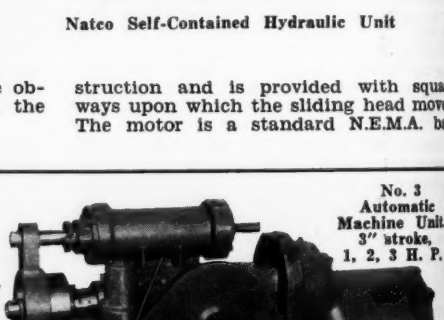
A hydraulic unit that is completely self-contained, interchangeable, and so designed as to provide a maximum of flexibility has been developed by The National Automatic Tool Company, Richmond, Ind. In designing this unit, the primary idea has been to provide standard compact units which could be arranged in groups to drill all holes in the several sides of a piece at one handling, yet which should be sufficiently flexible and interchangeable so that they can be rearranged and reequipped with drill heads for other work with a minimum of lost time and labor.

No connection other than electrical are required; all piping is in the interior of the unit. The cylinder is bolted to the sliding head and moves back and forth with it. One motor drives the drill head and also the pressure pump. The main shaft extends through the unit from the rear to the front end, at which point a gear is provided for driving the drill head. Correct spindle speeds can be obtained by changing this gear and the gears in the drill head.

Drill heads are interchangeable on various units. The base is of sturdy construction and is provided with square ways upon which the sliding head moves. The motor is a standard N.E.M.A. ball

Natco Self-Contained Hydraulic Unit

Build Your Own Production Machinery at **Low Cost** by using



No. 3 Automatic Machine Unit. 3" stroke, 1, 2, 3 H. P.

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The MILLHOLLAND MACHINE UNITS are self contained—compact—and equipped with Individual Motor Drive; and one or more MILLHOLLAND MACHINE UNITS can be mounted around the work, either in Horizontal—Vertical—or Inclined Positions; and several operations carried on at one time.

MILLHOLLAND MACHINE UNITS are built for Drilling-Tapping-Boring-Milling. Made in sizes from 1/3 HP Motor Drive to 10 HP and can be equipped for Multiple Spindle Operations.

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bearing mounted open frame type, mounted on a bracket that is bolted to the rear end of the unit. The drive pinion is mounted direct on the motor shaft and meshes with a gear on the rear end of the main shaft. This gear, through a gear mounted direct on the hydraulic pump shaft, drives the pump.

A constant volume vane type rotary pump supplies the pressure to the hydraulic system, and a pressure gauge, together with a vibration protector and shut-off cock, enables the operator to check the oil pressure in the hydraulic system at any time. The unit proper is used as an oil reservoir and a visible oil level gauge is provided on the left hand side of the unit.

An independent control pushbutton is provided for setup and emergency operation, permitting the operator to control any head forward or reverse as desired. On machines with two or more heads a centralized pushbutton station controls the traverse motion of all heads simultaneously. A transfer selector switch transfers control to either the independent control station or the centralized control station as desired. Similar control is provided for the drive motors.

A balanced valve of the load-and-fire type, working in connection with trip dogs, controls the movements of the unit after the cycle has been started. The length of the rapid traverse and feed is adjusted by setting the valve trip dogs and the stop position is adjusted in the same manner. In case of emergency the pressing of a pushbutton will start the unit in rapid traverse.

Two independent feed controls provide adjustable rates of feed forward. The unit is furnished as standard with the following cycle: rapid traverse forward, first feed, second feed, rapid reverse to the starting position, and stop. A feed governor prevents fluctuation of the feeding rate. A feed overload reverse limits the pressure in the hydraulic system; when the set pressure has been reached, the unit will automatically reverse even though the cycle has not been completed.

Standard electrical equipment will be for 220 or 440 volts, 50 or 60 cycle, A. C. equipment for other current characteristics is available.

Globe Automatic Horizontal Tapping and Screw-Inserting Machine

To meet the demand for a high production tapping and screw-inserting machine, an automatic machine of horizontal design has been brought out by

HAND-EE Hi-Power GRINDER

Touching off worn dies is only one of many toolroom jobs that the new HAND-EE Hi-Power Grinder does faster, better and at lower cost. Handy on moulds, patterns, welds, production work or out on the job. Works at any angle and in hard-to-reach places. Extremely portable, yet powerful. 17000 R.P.M. 110 volt, A.C. or D.C.

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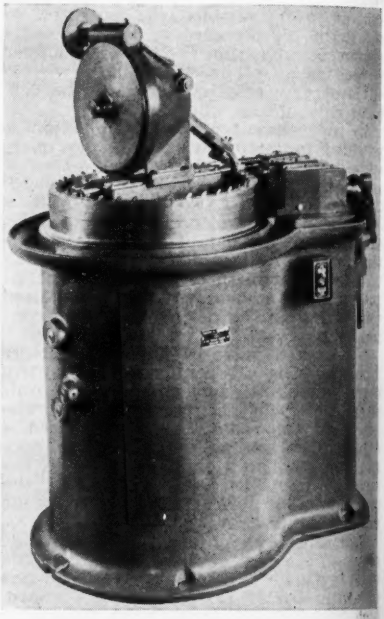
the Globe Tapping Machine Company, 751 Central Ave., Bridgeport, Conn. The machine will efficiently perform the operations of light drilling, tapping, threading, screw-inserting, burring, and so on. The operator is required only to place the parts into the dial ring; all operations on the work are automatic, including the ejection of the pieces.

The machine is so designed that every operation is visible, and all parts are



Globe Automatic Tapping Machine

easily accessible for adjustment. Units can be placed in vertical position, or at any angles required. Uniform shaped parts can be fed to the dial ring by means of a hopper if desired.

The machine is driven by a single 1200 r.p.m. motor mounted on an adjustable tilting plate in the base of the machine. To change the speed of the machine, the gear on the motor shaft is changed. Coolant is supplied from a tank in the base. All bearings in the machine are automatically lubricated by a special lubrication pump.

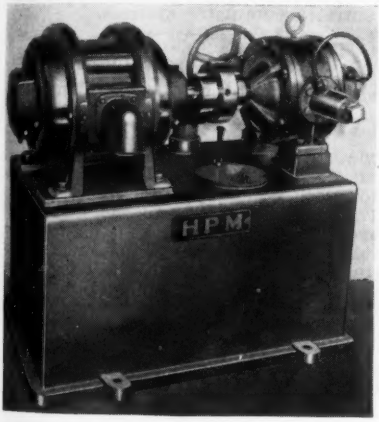
The machine illustrated is tooled up for tapping, hopper-feeding and inserting machine screws, upsetting the thread on

the screws to prevent loss, backing out the screw, and automatically ejecting electrical contact blades at a rate of 80 pieces per minute. The ejection is controlled by the screw and the screw that is placed in each piece acts as an automatic inspector in that only completed parts in them are ejected. This same machine can be converted for the handling of any other parts upon which the same operations are required, by changing the dial ring.

Advertisers like to know whether or not their advertisements are being read. When inquiring about machines, tools, or equipment advertised in this magazine, please mention MODERN MACHINE SHOP.

H-P-M Hydro-Power Units

To facilitate the application of the new H-P-M Radial Oil Pressure Pumps to various types of hydraulically actuated machines, a line of standardized H-P-M Hydro-Power Units has been developed



H-P-M Hydro-Power Unit

by The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio.

Each Hydro-Power Unit incorporates an H-P-M Radial Pump Pressure Generator, direct-driven from an electric motor through a flexible coupling. Both pump and motor are mounted on a base of steel plate, formed and welded. The base is completely enclosed so as to also serve as a reservoir for the oil used as pressure fluid and lubricant. This reservoir is completely equipped with all essential accessories including removable end cover,

THURCO

Improved Double End Mill Chuck

PATENT PENDING

SAVE 25 to 30% in Production Costs

5 REASONS WHY . . .

1. PRODUCTION INCREASED

Cuts down set-up time. No running around. All work done on spindle end of machine after once set up.

2. ECONOMICAL

Cuts cost of end mill through use of THURCO Double End Mills. Two cutting ends — not shanks — to be scrapped.

3. TIME SAVED

Keeps your operator at the machine. In case of breakage just reverse THURCO Double End Mill and proceed.

4. BREAKAGE SOLVED

Holds absolutely secure. Has 3 to 4 times the gripping power of any other standard straight shank chuck.

5. ABSOLUTELY PRACTICAL

Only ONE chuck required. Any size straight shank end mill up to ⅝" in diameter can be used through the use of an inexpensive adapter.

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THURSTON MFG. CO

Providence, R. I.

covered filling strainer, air vent filter, level gauge and drain valve. It is also fitted to take a copper coil for cooling water circulation when operating conditions require auxiliary oil temperature regulation.

The pressure output of the radial pump is regulated by an automatic control which may be adjusted for any value within the operating limits up to 3000 lbs. per sq. in. A modified form of this control is provided with a second adjustment whereby the volume of pump discharge may be regulated to any amount from zero to maximum. This type of power unit provides a single stage of high pressure capacity up to 3000 lbs. per sq. in. or a medium pressure up to 1500 pounds, depending upon the radial pump employed. Such a unit is shown in the illustration.

When initial work or closing movements are to be performed at low pressure, a two-stage Hydro-Power Unit is recommended. This incorporates two pressure generating pumps; i. e. the high or medium pressure radial pump as mentioned above, plus a low pressure rotary pump to provide larger volume for the initial portion of the operation.

When the low pressure limit is reached its output is bypassed at zero pressure by an automatic H-P-M Unloading Valve which functions without shock or chatter.

Each machine served by one of these H-P-M Hydro-Power Transmissions becomes a flexible, independent production unit. Pressure loads are individually and automatically regulated to the work at hand; power consumption is likewise held to a minimum in close proportion to work performed, which is not true with group hydraulic drives from central accumulator systems.

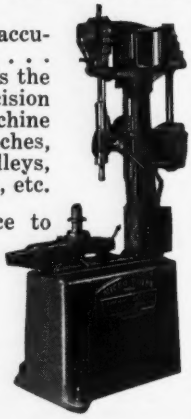
Tomkins-Johnson Hydraulic Electric Chuck-Operating Unit

A single unit for the operation of power chucks, shown in the illustration, has been brought out by The Tomkins-Johnson Company, Jackson, Michigan. The unit comprises an electric motor, hydraulic pump, tank, and the necessary valves and piping, all mounted on a single base as shown. It is compact in design and construction, and can easily be mounted on the machine.

The motor is mounted on the tank, and power is transmitted to the pump by means of a double V-belt. Oil is pumped to the pressure required through

PRECISION BALANCING

SIMPLE . . . accurate . . . fast . . . efficient . . . that's the Micro-Poise Precision Balancing Machine for balancing clutches, fly wheels, pulleys, fans, auto wheels, etc.



Detects unbalance to two-tenths ounce inch and measures depth to drill to correct it.

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Commerce Pattern Foundry & Machine Co.

2211 Grand River Ave., Detroit, Mich.

CULLMAN SPEED REDUCERS

FOR

Motors From 1/8 to 15 H. P.

NEW CATALOGUES ARE READY

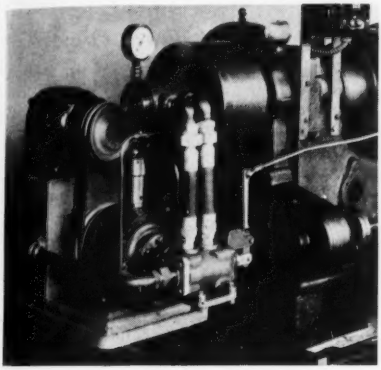
SEND FOR YOUR COPY

Cullman Wheel Company

1336 ALTGELD ST., CHICAGO, ILL.

a valve, into the distributor and cylinder to close the chuck. To release the chuck, the valve is reversed, reversing the flow of oil into the opposite end of the cylinder. The exhaust oil returns to the tank. A predetermined pressure level is maintained at all times.

The motor, although running con-



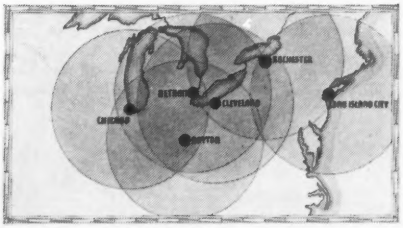
Tomkins-Johnson Hydraulic Electric Chuck-Operating Unit

tinuously, is not under load except for short intervals when the pressure, having dropped, is being returned to the desired level. By-passing of the oil has been eliminated, avoiding the heating of the oil to any appreciable degree.

Sturdimatic Heavy Duty Ball Bearing Line Center

A live center of new design, in which the contact member rotates on ball bearings, has been brought out by The Sturdimatic Tool Company, 5222 Third St., Detroit, Michigan. The design of the center is such that the load is distributed equally, and the savings effected are reputed to more than offset the higher initial cost within a comparatively short time.

Difficulties arising from the expansion of the work have been precluded by the manner in which the ball bearings are located in the center. The radial bearings (6) is mounted as closely to the work as possible to reduce overhang, this construction providing for strength without interferring with the tool clearance. The radial load is here transferred from the bearing (6) to the shank (2). The thrust load is passed through the nose and the rotor housing, between



WITHIN EACH OF THESE AREAS

A Danly Branch Office-Plant Offers You

Better Die Sets at Lower Cost

Within each of these areas is located a Danly Branch Office-Plant capable of shipping within 24 hours any one of the 18 standard Danly types and 998 combinations of size, thickness and material of shoe and punch holder with many thousands more of pin and bushing combinations.

The fact that these five Branch Office-Plants are maintained is the greatest proof that each is able to offer manufacturers in its area better die sets at lower final costs and with faster deliveries. Any one of these offices will be glad to place before you complete information on how the Unique Danly Plan makes this possible . . .

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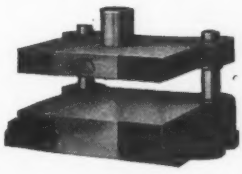


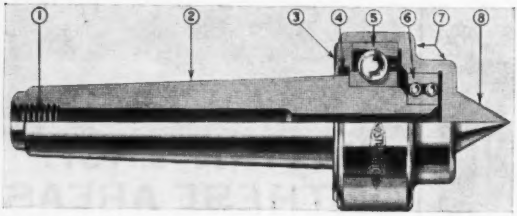
DANLY MACHINE SPECIALTIES, Inc.
2122 South 52nd Ave. Chicago, Illinois

DANLY
DIE MAKERS SUPPLIES

points (7) and a slight cushion action is obtained which protects the bearings from any thrust overload due to expansion of the work as a result of heat.

The outer race of the radial bearing (6) is made an accurate slide fit; thus not only is thrust overload prevented, but the slightest deviation from center is also prevented. For lubrication, a plug in the end of the shank (1) may be removed and an Alemite fitting substituted. A channel through the center of the shank carries the grease to the rotor chamber. At the rear of the thrust bearing a grit and grease seal is effected by the use of a steel ring (3) carrying a felt washer (4).

The center is made in nine standard sizes, in lengths of from 4⅜ in. to 17 9/32 in. and with Morse taper shanks from No. 2 to No. 7.

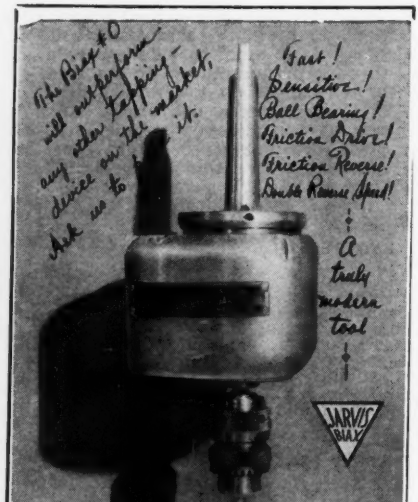


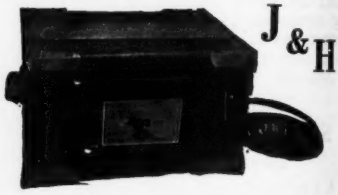
Sturdimatic Heavy Duty Ball Bearing Live Center

Hand-ee Hi-Power Grinder

The tool shown in use in the illustration is a high speed portable electric grinder that has been placed on the market by the Chicago Wheel & Mfg. Co., 110 S. Aberdeen St., Chicago, Ill. In design, the tool is well balanced, light, and compact, yet is said to be rugged and powerful enough for continuous, heavy grinding. The weight of the tool is three pounds.

Power is provided by a 110-volt universal motor which has a maximum speed of 17,000 r.p.m. The motor housing is of heavy cast aluminum, so designed that it extends out over the motor shaft. This portion of the housing is encased in a fully-insulated,





J & H

The **Demagnetizer**

For Alternating Current

THE J & H Demagnetizer requires no countershafts, belts, or other intricate electrical connections. All that is necessary is to plug it into the nearest lamp socket or receptacle.

It is of the new Unipole type—heavy duty—and can be supplied for either 110 or 220 volt alternating current. Size 12" long, 9" deep, 6" high. Weight 60 lbs.

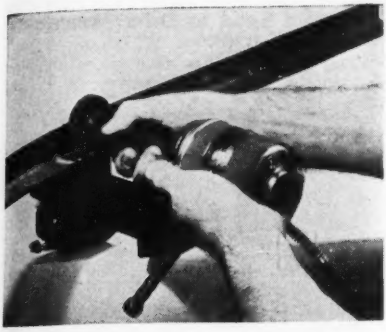
Sold On One Week's Trial!

J. & H. Electric Co.

202 RICHMOND STREET, PROVIDENCE, R. I.

cushion grip which provides positive control and the maximum of flexibility with a minimum of fatigue.

The shaft operates in high speed dust-sealed ball bearings. Three grinding wheels are furnished with the tool, and



Hand-ee Hi-Power Grinder

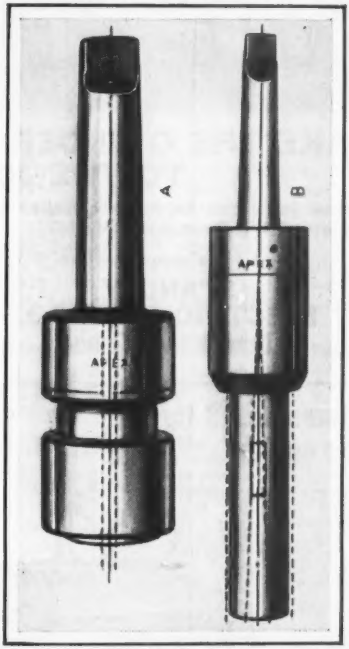
more than 100 shapes and sizes of Chicago grinding wheels are available. A 10-ft. reinforced rubber-covered cable with soft rubber attachment plug is furnished as standard equipment, together with all wrenches required for operation. Specially-balanced case hardened chucks and spindles are also available. The length of the tool overall, including the chuck, is 10 in. and the diameter is 3¼ inches.

U S L "Protected Arc" Welder

The illustration shows the USL "Protected Arc" electric welding machine which has been placed on the market by the USL Battery Corporation, Arc Welder Division, Niagara Falls, N. Y. The complete mechanism including motor, generator, exciter, controlling devices and all wiring is enclosed in a heavy sheet steel cylinder with straight lines and no protruding parts. The welder can be used in the open without covering as it is entirely protected from the weather. The mechanism is, however, easily accessible by raising a hinged cover on the commutator end of the machine.

The feature of the machine is its wide welding range, due to the rating of 40 volts, which is said to exceed by 60 per cent the NEMA and U. S. Navy specifications. The welding range is from 40 to 550 amperes. Open circuit voltage is 25 to 80 volts. The manufacturers state that the inherent stability of the welder

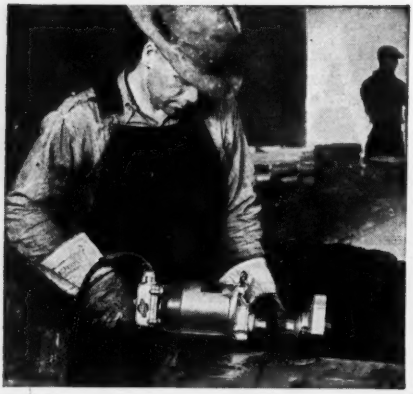
APEX
TRADEMARK
PATENTED
FLOATING
TOOL HOLDERS



APEX Floating Tool Holders compensate for misalignment between tool and work—Ball Bearing Float. For Reaming, Tapping, Drilling, Boring, etc., on single or multiple spindle machines. Can be used in any position—Furnished with straight shanks for screw machine use. Eliminates bell mouthed and tapered holes. Free floating tap collets insure true tapped holes.

Write for complete information on these cost reducing tools.

THE APEX MACHINE & TOOL CO.
THIRD & MADISON STS., DAYTON, OHIO



TAKE THE GRINDER TO THE JOB

Many jobs can be done quicker and easier with a Portable Grinder.

Ask for a demonstration

STANLEY ELECTRIC TOOL CO.
New Britain. Conn.

Ames No. 13 Upright Gauge Has wide range of uses in measuring odd shaped parts—ground base—bracket with indicator is adjustable.

Write for Circular

B. C. Ames Co.
Waltham, Mass.

has been increased to such a point that a constant flow of electrical energy is produced and current lag is reduced to the minimum, eliminating extreme fluctuations of current and voltage. Two convenient current and voltage controls permit any voltage and current combination desired, to weld anything from this sheet metal to heavy parts such as locomotive frames.

The generator has four poles and four interpoles, giving full range of welding

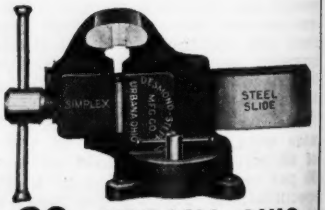
USL "Protected Arc" Electric Welder

current with perfect commutation at all loads. Extra heavy ball bearings are used throughout. The motor is the standard induction line start type, and the starter is the magnetic, push button type providing under-voltage and overload protection. The armatures of the motor, generator, and exciter are all mounted on a single extra heavy duty shaft, eliminating the possibility of misalignment, reducing friction, and providing a more compact design. A fan and ventilating system keeps the welder cool.

SIMPLEX STEEL SLIDE VISES

The front slide is unbreakable, being machined from a solid bar of steel. Hardened steel jaws are securely fastened with screws and dowels. A square cut screw of high tensile strength steel insures maximum pull. These vises are stronger and cost no more.

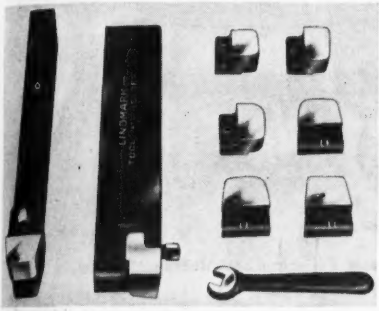
Write for literature and name of nearest dealer.



DESMOND-STEPHAN MFG. CO., URBANA, OHIO

"Apex" Tools for Turning and Dressing Car Wheels and Tires

The Apex Tool & Cutter Co. Inc., Shelton, Conn., has brought out a toolholder especially designed for use in



"Apex" Car Wheel Turning Tools

turning and dressing car wheels and tires. Two of the holders, together with an assortment of toolbits ground for the various cuts, are shown in the illustration.

The standard holders are made to fit the toolpost of the Sellers, Niles, or Putnam wheel-turning lathes, and are made interchangeable to accommodate either right or left hand toolbits. The toolholder is provided with two slots which permit of adjustment sidewise, this feature being intended to permit of repeated grindings, thus extending the life of the toolbit. Toolbits are supplied of high speed or cobalt steel, hardened and ground ready for use.

A holder for use in grinding the toolbits, to hold either right or left hand bit, is also provided.

Weston Photronic Kit

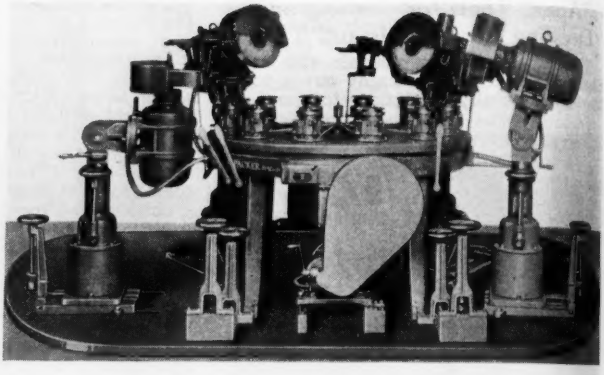
The Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark, N. J., has announced an inexpensive Photronic (photo-electric) Control Kit which is being marketed especially for those engineers and manufacturers who prefer to do their own experimenting with photo-electric control for mechanical equipment, operations and for processes of various kinds.

The kit contains all the equipment necessary for the engineer to start immediate experiments, together with dia-

LENOX "HIGH SPEED" BLADES
...Made "Extra Tough" to Stand Extra Wear!
Bend a Lenox High Speed blade nearly double—it won't snap. Twist it completely around—it won't break. The ends won't pull out. It stands up under unusual conditions of wear and abuse. These qualities, plus its performance and uniformity make it the most profitable blade to use.
LENOX
HACK SAWS
BAND SAWS
AMERICAN SAW & MFG. CO.
SPRINGFIELD, MASS., U. S. A.

grams of connections. The equipment can be used as a smoke detector, burglar alarm, turbidity detector, door opener, counter for all classes of service, safety device on machines, and so on.

The cell included is the Weston Photronic Cell, which has the peculiar faculty of transforming light energy directly into electrical energy and operates the Weston relays without the use of any auxiliary apparatus or batteries. As far as is known, the cell has unlimited life and the output is constant. Its spectral response is about the same as the human eye, so that it is extremely sensitive to color changes and is finding wide application wherever processes must be controlled by changes in color.



Packer Automatic Polishing and Buffing Machine

Packer Automatic Polishing and Buffing Machine

An automatic polishing and buffing machine designed to automatically polish and buff both flat and concave surfaces has been brought out by The Packer Machine Co., Meriden, Conn. The machine consists of a base upon which are mounted a bed with a motor-driven work table and a series of individually motor driven work-units, to which can be applied either polishing or buffing wheels as desired.

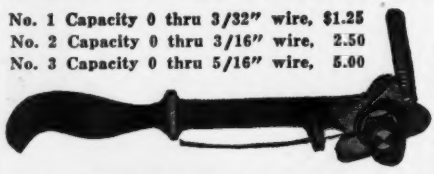
The work table is driven by a four-speed motor, the speeds of which are controlled by means of a hand lever mounted on the motor. Work-holding fixtures are fitted to the automatic expansion chucks as illustrated, a fixture being supplied for each spindle used. Work up to 12 in. in diameter can be accommodated in the machine shown.

The machine is intended to be used with either four or five heads, the wheel spindles being driven by 3, 5, or 7½ h.p. motors. Adjustments are provided which allow the wheels to be set at any angle from horizontal to vertical, or to be swiveled to any position. All controls are centralized at the front of the machine, allowing full control of the machine from the operator's position. All mechanism under the work table operates in a dust proof oil reservoir, and the running parts are equipped with anti-friction bearings.

The machine is built in several sizes, to accommodate the several different sizes and classes of work. The machine illustrated, which is the No. 2 size, requires floor space of 9½ x 8 ft. and weighs 9,700 pounds.

HERE'S A REAL SPRING WINDER!

No. 1 Capacity 0 thru 3/32" wire, $1.25
No. 2 Capacity 0 thru 3/16" wire, 2.50
No. 3 Capacity 0 thru 5/16" wire, 5.00



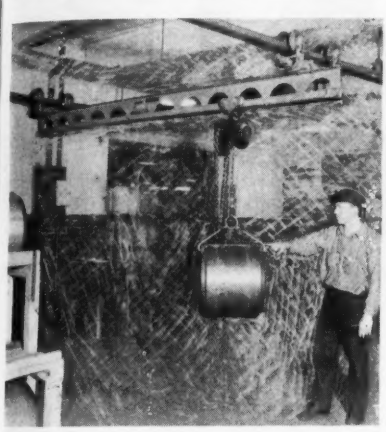
Will Earn Its Cost in One Day

The HJORTH Perfection Spring Winder offers the ideal means of winding extension, compression, torsion, taper, double taper, or left hand springs. Try one in your shop. You'll like it and the price is reasonable.

HJORTH LATHE & TOOL CO. 60 STATE ST. BOSTON, MASS.

Cleveland Tramrail Type CHS Crane

The Cleveland Tramrail Division of the Cleveland Crane and Engineering Company, Wickliffe, Ohio, has placed on the market a line of cranes and transfer



Cleveland Tramrail Type CHS Crane

bridges of lighter weight, suitable for loads up to one ton where the bridge span is not over 16 feet. The cranes and transfer bridges are constructed of lengths of Tramrail 8-in. arch beam rail, used as the crane bridge, and standard Cleveland Tramrail 1-ton hand-propelled carriers as the end trucks, the end trucks being keyed to the beam in such manner as to prevent the possibility of misalignment.

The short wheelbase of the end trucks and the 5-in. minimum bridge overhang provide exceptionally close approach to the ends of the runways and close bridge

ANNOUNCING
The Improved OLIVER
DIE MAKING MACHINE
With Many New Features

Send for our new bulletin and learn how to cut die costs 30% to 60%.

OLIVER INSTRUMENT CO.
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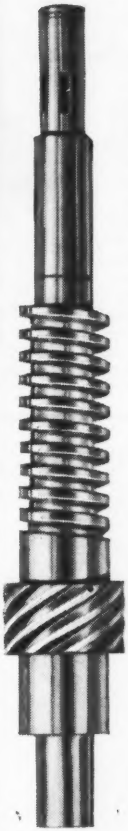
It's Good Business to choose

PERKINS GEARS



Years of experience in gear making . . . use of specially designed equipment . . strict adherence to highest standards of workmanship . . and the use of finest quality materials . . these are the reasons it is good business to choose Perkins Gears . . . gears for all purposes. Let us quote you on your requirements.

Write for Catalog

Our 102 page catalog will assist you in selecting the right gears. It contains tables and gear calculation data. You will find it helpful.

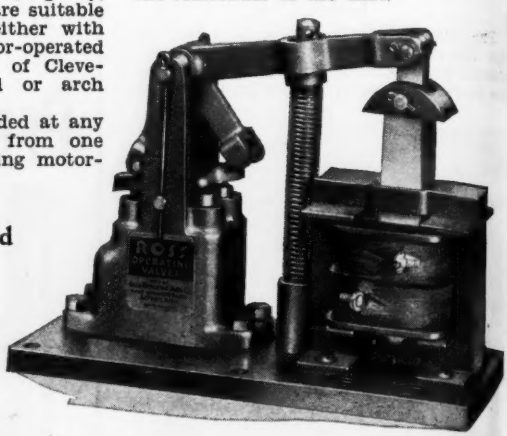
PERKINS MACHINE & GEAR CO.
151 Circuit Ave.
SPRINGFIELD, MASS.

clearances. The units are said to have exceptional qualities of strength, rigidity, and ease of operation. They are suitable for hand-propelled carriers, either with or without chain or motor-operated hoists, operating on runways of Cleveland Tramrail standard rail or arch beam.

Electrical fittings can be added at any time to change the system from one using chain hoists to one using motor-operated hoists.

Ross Solenoid Controlled Operating Valve

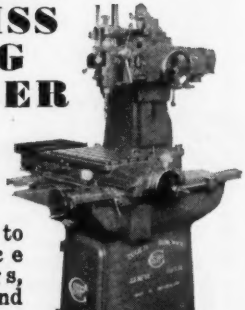
Announcement is made by the Ross Operating Valve Company, 6488 Epworth Boulevard, Detroit, Michigan, that they have now developed and are ready to furnish all standard sizes of Ross Operating Valves for solenoid control. This line includes units for either alternating or direct current in pipe sizes ranging from ⅜ in. to 1¼ in. Their design is both simple and compact and after installation permits the removal of either the valve or solenoid without disturbing the remainder of the unit.



Ross Solenoid Controlled Operating Valve

The use of Ross Solenoid Controlled Valves not only makes possible remote control, but creates a material saving

A NEW SWISS JIG BORER



It is easy to produce small jigs, tools, and production pieces with this machine.

Ask for pamphlet 560. It tells all about this new MP-2C machine.

THE R.Y. FERNER COMPANY

1133 Investment Bldg., Wash., D. C.

Anderson Improved

Balancing Ways

No Leveling Required

A simple and excellent device for balancing, straightening and trueing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in Lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000

Four chilled iron discs rotate on sensitive special bearings

Write For Full Information

Mfd. By **Anderson Bros. Mfg. Co.**

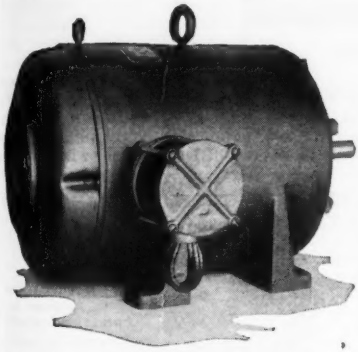
1926 Kishwaukee Street, Rockford, Ill.

in air costs by bringing the valve closer to the cylinder it controls. Ross Solenoid Controlled Valves can be furnished with single solenoids, as shown in the illustration, or with double solenoids for operations where it is essential to have a neutral or "off" position.

Ideal Totally Enclosed Fan-Cooled Motor

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has developed a totally-enclosed, fan-cooled motor, fully protected with all the advantages of dust tight construction, and the same size as the ordinary open type motor of same rating.

Full protection is provided against explosive dust, abrasive dust, corrosive gases



Ideal Totally Enclosed Fan-Cooled Motor

or fumes, current-carrying dust, and steam or moisture. For this reason, the motor is especially suitable for use in steel mills, metal working plants, foundries, and other plants where the above-named detrimental elements are encountered.

The construction employs two shells, the inner shell being dust tight and enclosing windings and rotor. Tight sealing is obtained by machined metal-to-metal stationary joints with long close fits. No running seals are used. A fan mounted outside this shell forces a blast of air between the inner shell and the outer one, thereby providing effective cooling.

These motors are made in all sizes from 1 to 200 h.p. as squirrel cage induction motors to meet all classifications of torque and inrush requirements and with 1, 2, 3 or 4 speeds. They are available

This Keyseater

Will cut keyways up to 1" in width

It has

QUICK SET-UP

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Davis Keyseater Co.

Exchange and Glasgow Sts.
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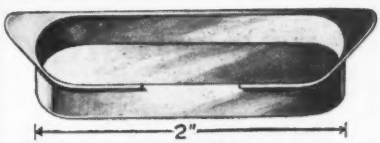


Drawn Shells In Small Lots

The cost of producing the first 100 drawn shells as shown was only $30.00 and $2.50 for each subsequent 100 at any time thereafter.

Special drawn parts can be made for you in proportion to the above costs, assuring accurate parts with exact duplication throughout the entire lot.

We will be very glad to quote on your shell drawing requirements by return mail.

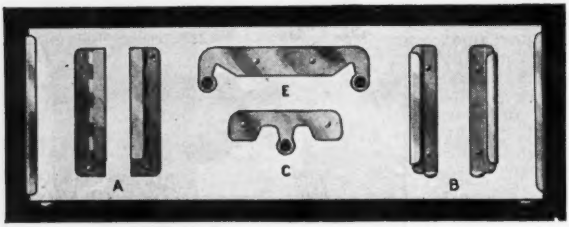
DAYTON ROGERS MANUFACTURING CO.
1114 So. 3rd St.
Minneapolis, Minnesota

also as across-the-line-start motors up to 200 h.p. and can be supplied for power factor correction as 100 per cent or 80 per cent leading power factor induction motors in all sizes.

Detroit Universal Card Holders and Clips

The Detroit Stamping Co., 3445 W. Fort St., Detroit, Mich., has introduced a line of universal card holders and clips in blue cold rolled steel units which can be assembled to make up any size or shape of holders for bulletins, notices, display cards, bin cards, and so on. The finish is such as to provide a base for any finish preferred by the user. The units can be tacked on the walls as they are made up. Certain members may be had with integral ball clips with which paper or cardboard can be held securely.

The assembled set displays nearly the entire edges of the card, and the card can easily be changed or removed. Samples of the holders in any of four different sizes may be had upon request.

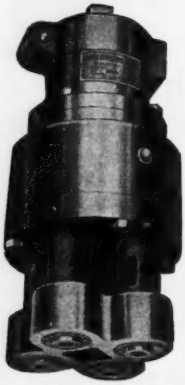


Detroit Universal Card Holders and Clips

"Machinist's Practical Guide"

A book of compact and handy size, containing a fund of information for the mechanical supervisor, is being put out by The Morse Twist Drill and Machine Co., Dept. 32, New Bedford, Mass. The book contains tables of tapers, speeds and feeds of carbon and high speed drills for the several different kinds of metals, instructions for the grinding of twist drills for the different materials, tables

Save Money & Time



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. . . enables you to machine accurate and smooth surfaces on small bosses, etc., in less time than by any other method. Better investigate! Send for a bulletin.

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of every description — completely assembled or
STAMPINGS
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You will be surprised at how much time, money and trouble you can save by reference to Bunting's 8-page catalog of parts and materials in constant use in a busy machine shop.

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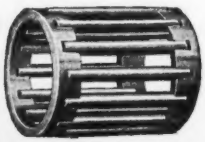

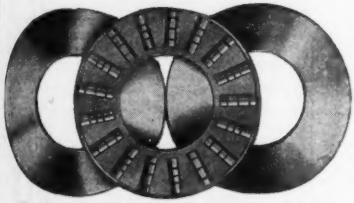

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Purchasing agents and all other executives interested in machining economies should have the information contained in the booklet illustrated below. It describes the four ways of purchasing Carboloy tools to obtain the most economical and convenient use of cemented carbide for your particular machining applications. Each method of purchase is fully described and illustrated, together with a brief summary of the advantages and limitations of each. With this information you may judge for yourself the most desirable method to employ in your own plant. The coupon below will bring you this booklet promptly, and without obligation.

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Company.....
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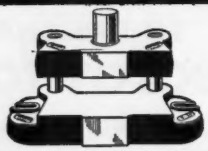
BAUMBACH



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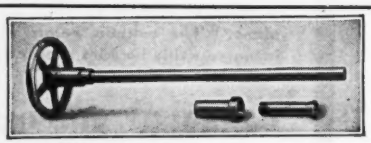

Collet Attachments for your lathes and millers

Write for Bulletin No. 100 A. M.—
Rivett Draw-In Collets and Chucks.
Also Price List and Dimension Sheet.

Rivett Lathe & Grinder Corp.

Brighton Dist., Boston, Mass., U. S. A.

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MODEL 223

PYROMETER

For the Hardening Furnace

Price complete without protection tube. $40

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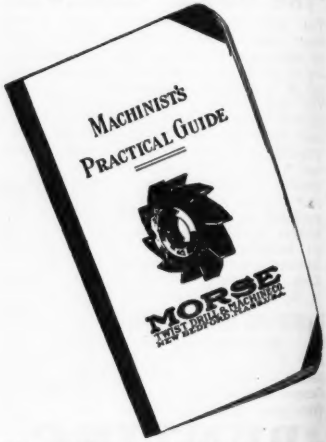
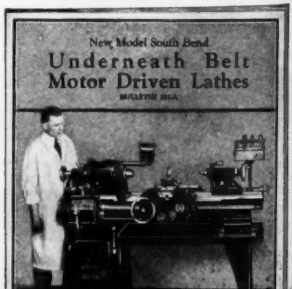
of thread dimensions and tap drill sizes, instructions for measuring screw threads with wires, cutter speeds for various



metals, cutting lubricants for the different materials, rules for finding dimensions of geometric figures, calculation of pulley speeds, and many other tables and formulas. A copy of the book will be sent without charge to any mechanical executive who addresses the firm as above.

New Catalog Describes Maintenance Shop Lathes

"Underneath Belt Motor Driven Lathes" is the title of a new catalog just published which illustrates and describes eight sizes and types of South Bend underneath belt motor driven lathes



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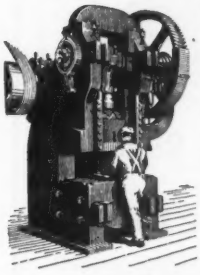

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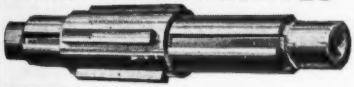

TURNING a solid mandrel up for every job is nearly as bad shop practice these days, as making a solid reamer for every job instead of using an expansion reamer. Write us about Expanding Mandrels.

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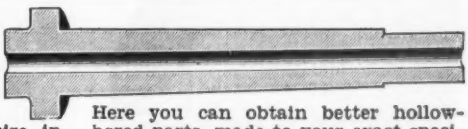

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Here you can obtain better hollow-bored parts, made to your exact specifications, quicker and cheaper than making them yourself. Let us prove it . . send your blue-prints for complete data and prices.

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RATES
$1.50 and up Single
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DETROIT

These lathes are of the back-geared, screw cutting type and are adaptable for the machinery maintenance shop, general repair shop, automotive service shop, engineering laboratory work, factory production and tool room work. The lathes shown are from 9 inch to 18 inch swing size and are available in bed lengths from 2½ feet to 14 feet.

In addition to the underneath motor driven lathes, there is also shown a complete range of countershaft drive lathes. Attachments, chucks and tools fitting both types of lathes are listed and described. Any reader may obtain a copy of Buletin No. 101-A by addressing Technical Service Dept. 69, South Bend Lathe Works, South Bend, Indiana, and mentioning this publication.

"Ready Reference For Plastics"

Engineers and production executives who are concerned with the uses of plastics in manufacturing will find descriptions, together with specific mechanical and electrical properties, of the nine most common types of plastics in a booklet that has been issued by the Boonton Molding Company, Boonton, N. J. The book contains twenty-six 8½ x 11 in. pages, and the text consists of descriptions of the various plastics, information as to the most suitable plastic for each of the various uses to which plastics are put, types of molds required for the different kinds of plastics, colors possible with each, properties, and instructions for working. Copies gratis.

Building Vending Machines

(*Continued from page 12*)

again to its original position. The mechanism is so finely adjusted that the blade slips when the screw is in the work to its full length; thus no screws are damaged and no harm is done to the screwdriver blade. With this machine the 18 screws are set and driven at the rate of approximately 450 screws per hour.

The illustration Fig. 10 shows a section of the final assembly room, where all kinds and sizes of coin-operated vending machines and automatic games are shown in process of building. As can be seen, the workers ply their vocation in a modern, well-lighted plant.

Jenkins Data Book on Valves

An excellent source of information on valves and valve layout is the new Catalog No. 23 just published by Jenkins Bros., 80 White Street, New York. Not only does this book cover 400 Jenkins Valves, in a wide range of types and patterns, but also it gives unusually complete details. All features of design and construction are clearly and fully described. Full information is given about the metals used in making the valves. Services, pressures, temperatures and fluids for which the valves are recommended are stated. In fact, this Catalog gives all of the facts that a valve buyer wants in selecting and specifying valves. The last section of the book contains many pages of engineering data that is useful where valves are used. Copy free upon request.

Advertisers like to know whether or not their advertisements are being read. When inquiring about machines, tools, or equipment advertised in this magazine, please mention MODERN MACHINE SHOP. Your cooperation will help to build up a bigger and better magazine for your own benefit.

PATENTS Before too heavy an outlay of time or money is made on an invention, a search of the Patent Office records should be made to determine as nearly as possible whether or not the same idea has been patented before. The cost of this search is small, while the value of the facts it uncovers is often considerable. We offer inventors and manufacturers a thorough, prompt, confidential search service—plus experienced counsel and assistance in every phase of Patent and Trademark practice. Write for my free book containing valuable information relating to patent procedure. **CLARENCE A. O'BRIEN, Registered Patent Attorney, 583-A Adams Building, Washington, D. C.**

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Made in Various Sizes and Styles

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Undercut Tooth

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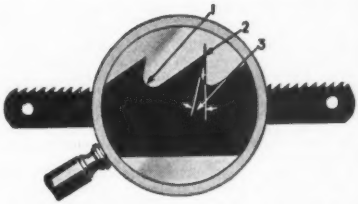

The "Whale Brand" Hack Saw Blades feature an Undercut Tooth which assures faster cutting, longer life and less breakage. Here is why:

1 Large round gullet allows chips to curl free and not clog in teeth. Prevents breakage.

2 Keen, sharp edge insures long life.

3 Undercut tooth requires less pressure per stroke. Less number of strokes to cut piece.

The Undercut Tooth is manufactured under a patented process.
Modern machinery and proven methods make certain that each and every Whale Blade is uniform in quality.

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Send For Trial Blade

Try this blade in your own shop. We will gladly send a sample blade to department heads and executives writing on their company stationery. See for yourself how the undercut tooth saves time and increases the life of the blade.

"Whale Brand"

The Hacksaw Blade with the undercut tooth.

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For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than five.

Chucks—Key and Keyless: Bulletin No. 120A, 632, and 633, issued by T. R. Almond Mfg Co., Ashburnham, Mass., describe and illustrate the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copies free upon request.

Cut Your Sawing Costs: "Lenox" hack saw blades and band saws are guaranteed to effect savings on your sawing operations. Write for information to American Saw & Mfg. Co., Springfield, Mass.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine & Tool Co., 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

A New Deal in Hacksaw Blades: "Blue End" Hacksaw Blades reduce costs by cutting faster and lasting longer. Write for data and prices to E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

"Atlas" Bench Lathe: A 9-in. screw cutting, self-contained, motor-driven bench lathe is now being built by Atlas Press Co., Kalamazoo, Mich. Write for circular.

Correctly-Designed Ball Bearings: The Auburn T-114-RG Ball Thrust Bearing does the work of a large bearing at a minimum of cost. Write Auburn Ball Bearing Co., 69 Clarissa St., Rochester, N. Y.

Irregular contours on dies or tools can be finished accurately and fast by the use of the No. 2 Baker Grinder. Write Baker Brothers, Inc., Toledo, Ohio, for descriptive bulletin.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourn Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Bushings and Bearings: 500 sizes of finished bronze bushings that are available immediately are shown in a catalog that can be had by writing to The Bunting Brass & Bronze Co., Toledo, O.

"The Inside Story" is the title of a book that will tell how hard castings can be machined, scrap reduced, and tool costs cut by the use of Carboloy. Write for copy to Carboloy, Inc., 2485 E. Grand Blvd., Detroit, Michigan.

Mounted Grinding Wheels for use in small holes such as are found in bushings, dies, gears, tools, etc., are described in a catalog that has been issued by the Chicago Wheel & Manfg. Co., 110 S. Aberdeen St., Chicago, Ill. Copy free upon request.

Balance Your Parts the Micro-Poise Way: Vibration can be removed from flywheels, fans, wheels, and other rotating parts by eliminating dynamic unbalance. Ask Commerce Pattern Foundry & Machine Co., 2213 Grand River Ave., Detroit, Michigan, for full information.

Centerless Grinding: A high-speed service at low cost. If you have cylindrical parts to be ground, send blue-prints for estimates to Commercial Centerless Grinding Co., 6538 Carnegie Ave., Cleveland, Ohio.

Boring Tool With Micrometer Adjustment: A circular describing and illustrating the Palmgren Off-Set Boring Tool, which is adaptable for either tool or production work can be had by addressing the Chicago Tool and Engineering Co., 84th St. and So. Chicago Ave., Chicago, Ill.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

"Hypro" Planers: The most modern engineering practice is incorporated in the design of Cincinnati "Hypro" Planers, made by the Cincinnati Planer Co., Oakley, Cincinnati, Ohio. Write for catalog.

Davis Keyseaters: The newest methods of keyseating are discussed in a bulletin that also describes and illustrates the keyseating machines made by the Davis Keyseater Co., 250 Mill St., Rochester, N. Y. Copy free upon request.

Reduce Your Parts Costs: Stamped, formed, or drawn work produced by a new process and at reduced costs can be obtained from Dayton Rogers Manufacturing Co., 1114 So. 3rd St., Minneapolis, Minn. Write for information.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 1345 West Fort Street, Detroit, Michigan. Write for information.

Assemble by Power: A power screwdriver that will set and screw in machine screws at a rate of from 400 to 500 screws an hour is described in a folder that can be had by writing to the Detroit Power Screwdriver Co., 5365 Rohns St., Detroit, Mich.

"Speed" Spot Welders for welding metals from 0.0005 in. to $\frac{5}{8}$ in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th Street, Newark, N. J.

The Complete Pattern Shop: A machine that will saw wood or metal, drill, or turn pattern materials is described in a folder that can be had by writing to Electric Carpenter Co., Philadelphia, Pa.

Performance Data On Swiss Jig Borers: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Borers, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock-Absorbing Gears, and containing a fund of valuable data with rules and tables for laying out, cutting, and using gears can be had by addressing Formica Insulation Co., 4632 Spring Grove Ave., Cincinnati, O.

Secret of Fast Cutting: Use a hack saw blade with the correct tooth-clearance angle so that the metal will be cut—not pushed. Full information can be had by asking Forsberg Manfg. Co., 125 Seaview Ave., Bridgeport, Conn., for bulletin on "Whale Brand" Hack Saw Blades.

Stampings of any kind or size can be obtained from Greding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Ball and Roller Bearings, either journal or thrust, for all purposes and all sizes, are described and il-

lustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Arc Welder Manual: A complete exposition of arc welding technique, together with a discussion of the uses and advantages of the arc welding process is contained in a book that will be sent free upon application to Hobart Brothers, Box ME-91, Troy, Ohio.

Pyrometers: Inexpensive portable and stationary single unit and multi-circuit pyrometers are described in a catalog issued by Illinois Testing Laboratories, Inc., 146 West Austin Avenue, Chicago, Ill. Copy free upon request.

Oil and Waterproof Chucks: The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

Solve Your Tapping Problems with a Jarvis Tapper. Tapping devices for every type of job. Write The Charles L. Jarvis Co., Gildersleeve, Conn., for information and prices.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Drill and Tap at Any Angle: Self-contained drilling and tapping units can be adapted to any equipment, in any position. Write Millholland Sales Co., Indianapolis, Ind., for information.

Magic Chucks: Instantaneous change of tools without stopping the machine spindle can be accomplished by the use of Modern Magic Chucks, made by the Modern Tool Works, Rochester, N. Y. Write for descriptive booklet.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

"The Alloy Pot" is the title of a monthly publication that gives the latest news in the die casting field. Ask The New Jersey Zinc Co., 160 Front St., New York, N. Y., to put your name on the mailing list. No charge.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Stamp with Numberall: The complete set of figures or letters all combined in one tool, preventing loss of single letters or digits. Write for catalog. Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

Self-Locking Cutter Blades: Cutters are now being made in which the blades lock by shape alone, no pins, wedges, or screws being used. Write for information to The O. K. Tool Co., Inc., Shelton, Conn.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines, is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy, may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Flat Steel Wire to Meet Specifications of the most exacting buyers is now being made by John A. Roebling's Sons Company, Trenton, N. J. Send your specifications and ask for prices.

Foot-Controlled Air-Valve: Air-operated equipment can now be controlled by valves that are operated by the foot, leaving the hands free to operate the machine. Write for information to the Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, Michigan.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

An Electric Hand Shear will save time, material, and labor on jobs that are too small, too large, too complicated, or too cumbersome to be handled in the power shear. Ask The Stanley Electric Tool Co., New Britain, Conn., for catalog.

The Live Center you have been Looking For: The Sturdimatic Live Center has eight outstanding features; just what you have been looking for. Ask for bulletin and prices. Sturdimatic Tool Co., 5222 Third Ave., Detroit, Mich.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Double End Mill Chuck: A chuck that cuts down setup time, eliminates breakage, and holds any end mill up to ⅝ in. in diameter is now available. Write Thurston Mfg. Co., Providence, R. I., for information and prices.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tompkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Protection and Beauty can be added to the selling points of your product by applying a metal coat of Udylite-Cadmium. Ask Udylite Process Co., 3939 Bellevue Ave., Detroit, Michigan, for complete information as to equipment required, methods, costs, etc.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati, Ohio.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, toolpost grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electric Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

"Extra Value" Hack Saw Blades: Hack saw blades made of an alloy in which molybdenum is used, and which are said to withstand shock and wear to an unusual degree are now being made by Victor Saw Works, Middletown, N. Y. Full particulars will be sent upon request.

Toolmakers' Tool Chests: The complete line of fine tool chests for toolmakers and machinists made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Write for it.

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